Okanogan and Wenatchee National Forests Roads Analysis: Methow Sub-Basin

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Core Team Members

Marge Hutchinson	Team Leader, South Zone Engineer
David Colbert	Transportation Planner
Carl Davis	Forest Soil Scientist
Bill Gaines	Forest Wildlife Biologist
Andrea Gold	Wildlife Biologist
Ken MacDonald	Forest Fisheries Biologist
Tom Robinson	Forest Hydrologist
Jennifer Zbyszewski	District Recreation Officer

District Team Members

Mel Bennett	Hydrologist
Jack Ellinger	Road Manager
Jim Hammer	Road Manager
Tom Ketcham	Timber Management
Jennifer Molesworth	District Fish Biologist
Ann Sprague	District Wildlife Biologist
Janet Wilson	GIS Specialist

For more information, contact:
Methow Valley Ranger District
24 West Chewuck Road
Winthrop, WA 98862

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Introduction

Over the past decade, because of a national shift in environmental awareness, roads and road issues have become points of controversy. Roads are being scrutinized for their impact on ecosystems. Also, the funding available to maintain roads has decreased significantly. There is an urgent need to find a balance between the need for access and the potential environmental risks of a deteriorating road system. To meet this goal, the Okanogan and Wenatchee National Forests conducted a forest-wide roads analysis.

The objective of the roads analysis was "to provide line officers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions" (USDA FS, August 1999). This analysis is not a decision-making process. Strategies and recommendations developed with the analysis will be incorporated into future project-level decision-making analysis.

The following analysis is a science-based interdisciplinary process using existing information and inventories. The analysis addresses the effects of roads on biological, social, and economic factors. The condition of the current road system was analyzed in terms of desired conditions, which includes amount and type of access, and impact and risks to the ecosystem. This analysis identifies opportunities and strategies for moving toward the goal of an affordable, efficient road system that meets the needs of the public and the U.S.D.A. Forest Service with minimal impact to the environment. The analysis includes previously completed plans, analysis, and decisions.

This analysis is based on the objectives and guidelines in "Road Analysis: Informing Decisions about Managing the National Forest Transportation System," developed by the Forest Service Chief's Office in Washington, D.C. (USDA FS 1999). The guidelines present six steps that each analysis should complete. The six steps are:

Step 1: Setting up the analysis
Step 2: Describing the situation
Step 3: Identifying issues
Step 4: Assessing benefits, problems and risks
Step 5: Describing opportunities and setting priorities
Step 6: Reporting

The analysis of the Wenatchee Sub-Basin is a modified version of a process developed by the Umpqua National Forest and presented in "Upper Steamboat Creek Watershed Analysis: Access and Travel Management Planning Process and Results." The process was modified to reflect characteristics and situations present on the Okanogan and Wenatchee National Forests and incorporates the six steps listed above.

This is the first of a three-phase process to analyze all the roads on the Okanogan and Wenatchee National Forests. The second phase will be at the watershed scale: all roads within the watershed will be considered. The third, final phase will be at the specific project scale. The first two

phases (sub-basin level and watershed level) develop recommendations, and are not decision documents. The final phase, at the project scale, will be at the decision-and-implementation level.

The analysis process examines the major arterial and collector roads within the sub-basin. The roads were segmented according to their maintenance level and the watershed in which they are located. After the roads were segmented, they were rated on criteria in three modules: Human Use, Aquatics, and Wildlife. The Aquatic and Wildlife modules document the effects of roads on biological factors; the Human Use module addresses the effects of roads on the social and economical factors. The specific criteria in each module are described in the appendices.

Each module developed a "High," "Moderate" or "Low" rating for each road segment. The three ratings were used to develop a recommended management strategy for that road segment. The management strategy options ranged from major improvements to some form of decommissioning.

In addition, each watershed within the sub-basins was given an overall rating for each module. This rating was used to develop the recommended priorities and sequence for conducting the watershed scale of the Roads Analysis process.

After information from the completed sub-basin road analysis is completed, the information will be used in several ways:

1. The compilation of all of the sub-basin level analyses will form the comprehensive forest wide road management strategy.
2. More detailed watershed scale analyses will tier to the sub-basin data and recommendations.
3. Scheduled forest plan revisions will utilize the results in setting long-term management direction for the road system across the forests. The forest plan revision is scheduled to start in the spring of 2003.

Methow Sub-Basins Analysis Area

This analysis focuses on the major arterials and collectors (roads open and maintained for passenger car use) within the Wenatchee River Sub-Basin. The sub-basin boundaries closely correspond to the boundaries of the Methow Valley Ranger District on the Okanogan and Wenatchee National Forests. For more information, see the vicinity map (Figure 1) and the analysis area map (Figure 2).

The Methow Valley Ranger District has twelve fifth-field watersheds: the Upper Chewuch, Lower Chewuch, Upper Methow, Middle Methow, Lower Methow, Twisp, Pasayten, Lost River, Ashnola, Granite, Lightning, and Bridge Creek. The Pasayten, Lost River, Ashnola, and Lightning watersheds are located completely within the Pasayten Wilderness, and will not be included in any level of roads analysis. Highway 20 passes through the Granite Watershed, but there are no other roads within that watershed. This watershed will not be included in this roads analysis. Highway 20 also passes through the small portion of the Bridge Creek Watershed on the Methow Valley Ranger District. Two other short roads within this watershed access day-use recreation sites. This watershed was not included in this level of roads analysis because it does

not contain any level 3, 4, or 5 roads. The remaining watersheds--Upper and Lower Chewuch (combined into the Chewuch), Upper Methow, Middle Methow, Lower Methow, and Twisp--are included in this analysis.

The area of the sub-basin analyzed is 1,334,654 acres, of which 877,552 acres (66%) are in wilderness and inventoried roadless areas. The area contains approximately 1,588 miles of classified Forest Service Roads (FSRs), of which 287 miles of major arterials and collectors were analyzed. The remainder of the collectors, local roads, and unclassified roads were not considered in this analysis, but will be included in the future watershed-scale analyses. The remainder of the system roads and known unclassified roads will be analyzed during the second phase of roads analysis, scheduled for 2003-2004.

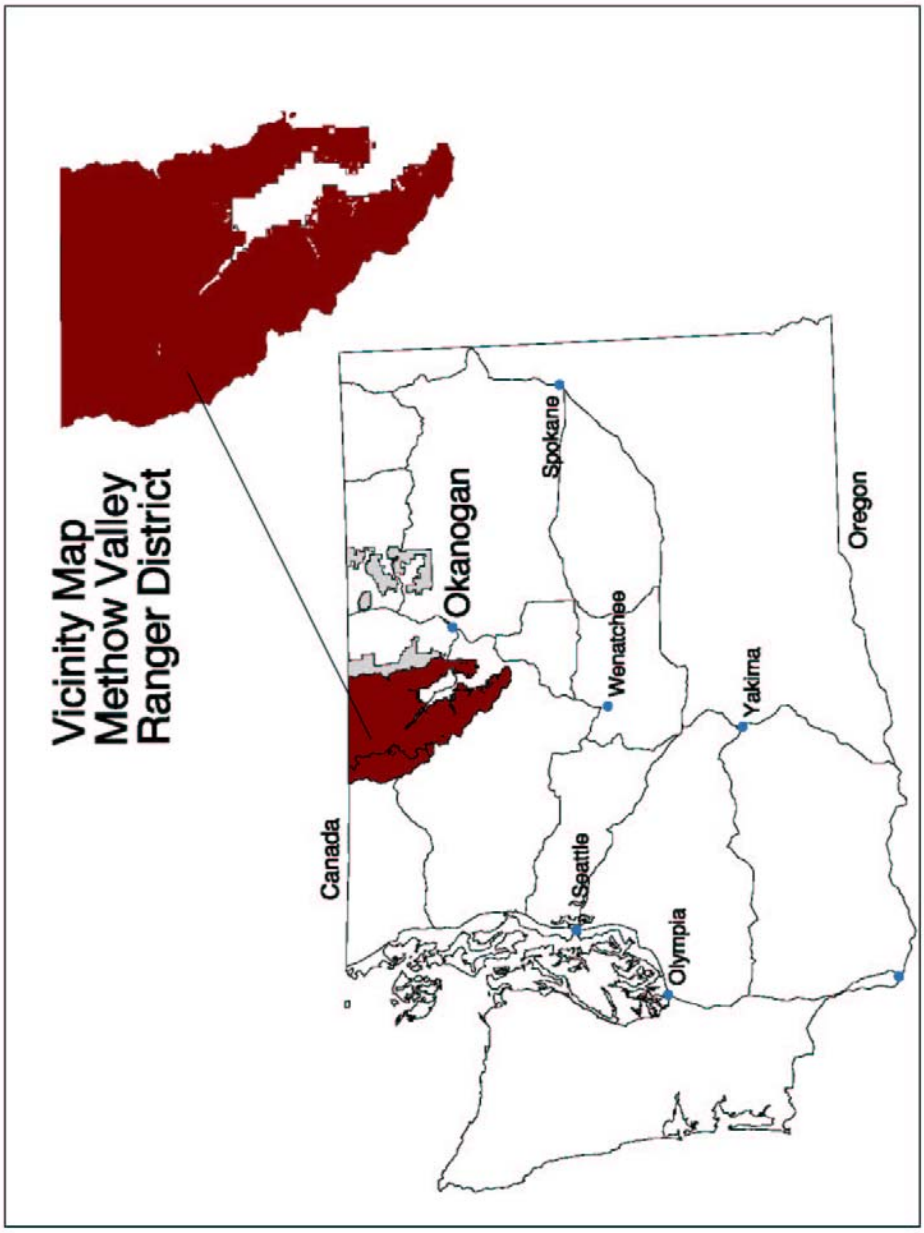

Figure 1. Methow Valley Ranger District vicinity map

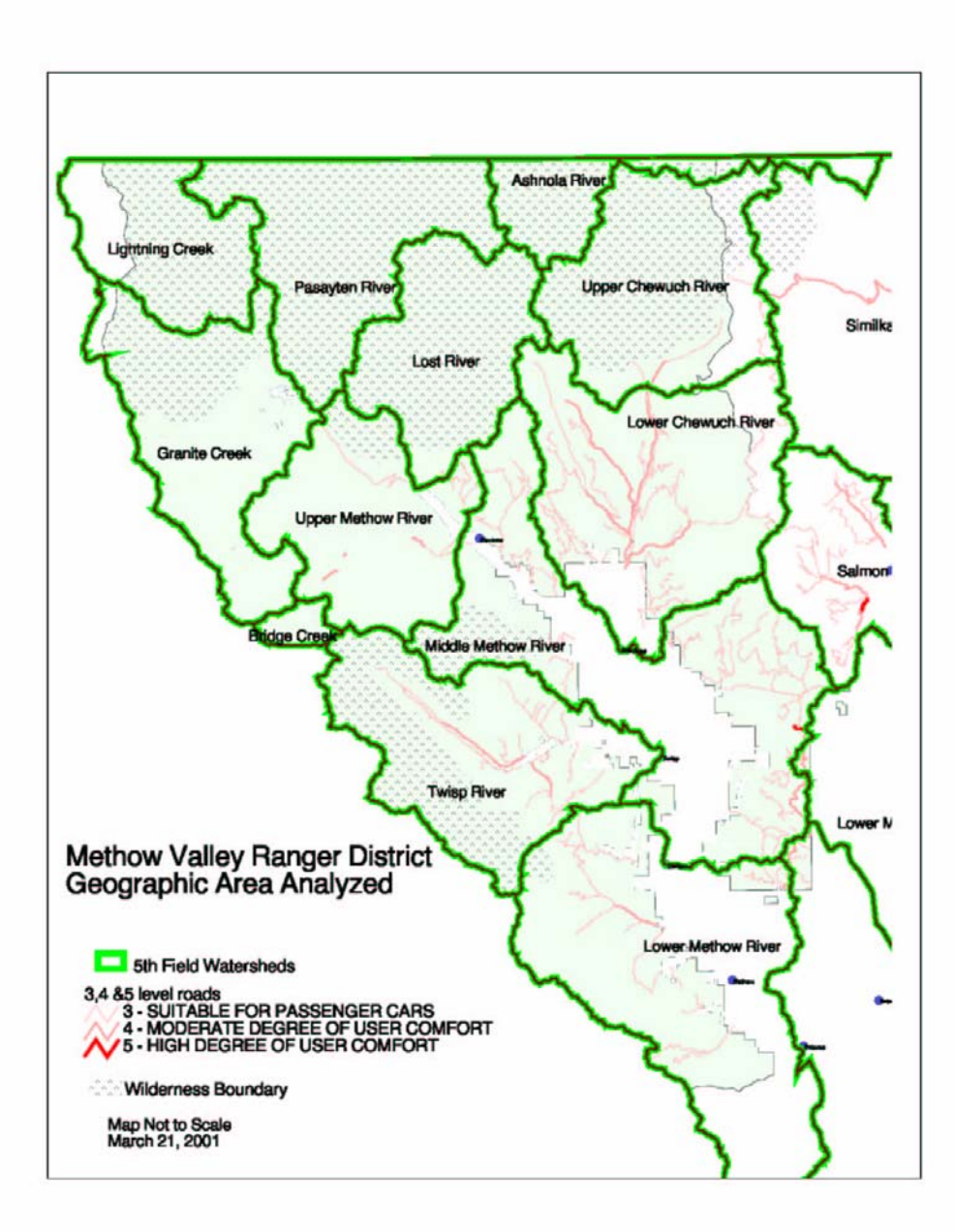

Figure 2. Geographic area analyzed on the Methow Valley Ranger District

I. Existing Conditions & Situation

General Conditions

A. Roads

The entry of non-indigenous peoples to the Methow Valley before the early 1900s was largely related to exploration and the fur trade. Travel was by foot or horseback and probably followed established native trails. Roads were constructed as settlement continued. The first state highway was constructed in the early 1900s, and followed the Methow River. It provided access from the town of Methow to the mining town of Barron. Although the route over the Cascades crossing at Washington Pass was surveyed in the 1930s, construction was not completed until 1972.

Many early forest roads were established as stock driveways or for mineral extraction. By the 1950s most new roads were being constructed for timber harvest. In time the demand for forest products increased, as did the need for additional roads. Equally as important as an economic element was the increasing interest in recreation and the recreation opportunities forest roads provided. Among these recreation opportunities are access to trails, boating activities, developed campgrounds, dispersed camping sites, and access to motorized recreation opportunities including high clearance vehicles, motorcycles, ATVs, and snow machines. Access to the area was increased by roads constructed by the public ("user-built roads") and termed "unclassified" by the U.S.D.A. Forest Service.

Today, the Methow River Sub-Basin has two state highways, State Route 20 and State Route 153, passing through the valley. Major forest roads take off from these highways, providing access to the Chewuch, Methow, and Twisp Watersheds.

This roads analysis also includes road-associated effects to the environment. Throughout the sub-basin the combination of road location, road surface type, and high public use patterns, in the wetter times of the year, produces a higher potential for increased road surface damage and sediment production. This is particularly evident on the native-surfaced roads that are extensively used during hunting season. In many cases, this combination of conditions results in rutted or wheel-track damaged roads.

For the purposes of roads analysis for the Methow River Sub-Basin, the Forest Transportation Management System (INFRA Roads database) describes each system road or road segment by assigning values which describe the way the road serves the resource management needs and the specific maintenance required, consistent with management objectives and maintenance criteria. In the past few years, the emphasis has been to gather road-related data within projects, such as inventorying and mapping unclassified roads, identifying the backlog of deferred maintenance work, and surveying road culverts which may be a problem for fish passage. Information provided by these other projects will be included at some level of the entire roads analysis process. A summary of the miles of forest roads in each watershed by road type and maintenance level is available in the analysis file. For descriptions of the maintenance levels, see Appendix F.

B. Aquatics

The Methow Sub-Basin includes the Methow River and all tributaries from the headwaters to the confluence of the Methow River with the Columbia River at the town of Pateros. Fish species protected under the Endangered Species Act of 1973 inhabiting the sub-basin are: upper Columbia steelhead (endangered), upper Columbia spring chinook salmon (endangered), and Columbia River bull trout (threatened). Other native salmonid species that are a management emphasis but not considered threatened or endangered are: summer chinook salmon, redband/rainbow trout, and west slope cutthroat trout.

The Yakama Nation, in cooperation with the other fish management agencies, is exploring the feasibility of reintroducing coho salmon into the sub-basin. Introduced non-native rainbow trout and brook trout are also present. The Yakama Nation, in cooperation with the other fish management agencies is exploring the feasibility of reintroducing coho salmon into the sub-basin. Introduced non-native rainbow trout and brook trout are also present. The Winthrop National Fish Hatchery raises spring chinook salmon, but the hatchery population is not considered to be part of the endangered spring chinook salmon population. The State of Washington Methow Hatchery is a supplementation facility for the native spring chinook population, although hatchery broodstock has been used in the past. The term "at-risk populations," as used in the roads analysis, refers to the spring chinook, summer steelhead and bull trout populations protected under the Endangered Species Act. One or more of the at-risk populations is found in each watershed within the sub-basin.

The six watersheds that make up the Methow Sub-Basin are the Chewuch, Twisp, Early Winters, Lower Methow, Middle Methow, and Upper Methow. Because there are no arterial or collector roads in the Early Winters or Lost Watersheds, no assessment was completed.

Significant sub-watersheds for a species are as defined in MacDonald et al. (1996). The original mapping in MacDonald et al. (1996) did not include the Methow Sub-Basin. Methow Sub-Basin mapping was completed as part of this roads analysis. Sub-watersheds are defined in MacDonald et al. (1996) as significant if they meet any one of the following criteria:

1. The sub-watershed was identified as a stronghold in the Interior Columbia Basin Ecosystem Management Plan Assessment.
2. The sub-watershed provides the primary spawning or rearing habitat for the species within the sub-basin.
3. The sub-watershed represents the only known occupied habitat within a fifth-field watershed and is fairly isolated from populations in other watersheds, and thus is significant from a distribution standpoint.
4. The sub-watershed contributes to the genetic integrity of a species.
5. The sub-watershed is known, or strongly suspected, to support a stable, strong population.

For the roads analysis process, those sub-watersheds significant for spring chinook salmon, steelhead or bull trout in the Wenatchee Sub-Basin have the greatest influence on the ranking of

a road segment since these species are protected under the Endangered Species Act and therefore priority for consideration. However, depending upon the watershed, significant sub-watersheds for west slope cutthroat trout, summer chinook salmon, and redband trout may influence the ranking, as well. The ranges of most of the salmonid species greatly overlap; therefore road management activities that have a positive or negative impact on habitat for at-risk species should, in general, have a similar effect on habitat for other native salmonids.

Current conditions are described and watershed scores developed using the following roads analysis rating factors (See the Aquatic Assessment):

1. Fine sediment
2. Floodplain function, off-channel habitat, and riparian reserves
3. Flow effects
4. At-risk fish populations

Because the Wetland and Wet Meadows rating factor is only used at the road segment level it is not discussed in the watershed condition section.

Section 7(a)(2) of the Endangered Species Act requires all federal agencies to review actions authorized, funded, or carried out by federal agencies to ensure such actions do not jeopardize the continued existence of listed species. Furthermore, federal agencies must consult with the National Marine Fisheries Service (anadromous fish) and the U.S. Fish and Wildlife Service (pertaining to inland fish) on on-going and new activities that may affect a listed species. The Okanogan and Wenatchee National Forests prepare biological assessments to assess the potential impact of management activities. The biological assessment and subsequent consultation is conducted at the watershed scale. The basis for the biological assessment is "A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale," prepared by the U.S. Fish and Wildlife Service (adapted from the National Marine Fisheries Service) in February 1998. An important portion of the biological assessment is establishing the environmental baseline for the watershed. In the baselines, various habitat and watershed features are rated as functioning appropriately, functioning at risk, or functioning at unacceptable risk. The fine sediment, floodplain function, off-channel habitat, riparian reserve and flow effects ratings in the roads analysis are based on the latest watershed biological assessment for a watershed, which is cited at the beginning of each watershed section. When available, new information from monitoring was also used. The watershed score for each rating element is shown next to the element; the narrative gives the rationale for the score.

C. Wildlife

This section describes the current conditions on the Methow Sub-Basin in order to develop an information base for making decisions about road management and their effect of roads on wildlife. The sub-basin analysis will identify the major arterial and collector roads for management, prioritize watersheds for further analysis at the watershed scale based upon potential restoration needs for wildlife habitats, identify issues within watersheds, and establish the context for watershed scale roads analysis.

Roads definitions are from the grizzly bear core analysis process and have been in use for wildlife analyses for several years. These analyses can be used to address wide-ranging carnivores, late-successional associated species, riparian-dependent species, ungulates, and unique habitats. Table 1 summarizes road-associated factors that affect wildlife habitats or populations (Wisdom et al. 1999). The analyses address the terrestrial wildlife (TW) roads analysis questions, TW (1), TW (2), TW (3), TW (4), and ecosystem functions (EF) question EF (2) identified in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" (USDA FS 1999). The analyses described in this document are an adaptation of the TW questions to better address the issues and conditions on the Okanogan and Wenatchee National Forests.

The following discussion describes the five elements of the wildlife analysis and then presents specific descriptions of important aspects within each watershed in the Methow Sub-Basin.

C1. Wide-Ranging Carnivores

Wide-ranging carnivores covered in this assessment that are known or suspected to occur within the sub-basin include the gray wolf (Endangered), wolverine (petitioned for listing), lynx (threatened), and grizzly bear (threatened). The entire Methow Sub-Basin is located within the North Cascades Grizzly Bear Recovery Zone. Several studies have documented the effects of road-associated factors on carnivores; these are summarized in Table 1. No conservation strategies or recovery plans currently exist for wolverine or gray wolves. A conservation strategy for lynx has been completed (Ruediger et al. 2000) but does not address potential indirect effects of roads on habitat quality. For all of these species, areas that are relatively free of human access provide refugium that is important for their long-term viability (Weaver et al. 1996). The availability of these areas is based on the amount of core area using the assessment process and definitions provided in Puchlerz and Servheen (1998).

Table 1. Road-associated factors that negatively affect habitat or populations of wildlife species (based on Wisdom et al. 1999) and the wildlife species group for which effects of the road-associated factor has been documented

Road-associated factor	Effect of the factor	Wildlife group affected
Hunting	Non-sustainable or non-desired legal harvest by hunting facilitated by road access.	Wide-ranging carnivores Ungulates
Poaching	Increased illegal take of animals, as facilitated by roads.	Wide-ranging carnivores Ungulates
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Chronic negative human interactions	Increased mortality of animals (such as euthanasia or shooting) due to increased contact with humans, as facilitated by road access.	Wide-ranging carnivores

Road-associated factor	Effect of the factor	Wildlife group affected
Movement barrier	Interference with dispersal or other movements as posed by a road itself or by human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats;
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to the establishment of roads, road networks, and associated human activities.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats

C2. Late-Successional Associated Wildlife Species

Over 100 wildlife species on the Okanogan and Wenatchee National Forests are associated with late-successional forest (USDA FS 1997). Table 1 shows the road-associated factors that have been identified to affect these species. These species include the northern spotted owl (threatened) and are managed through a network of late-successional reserves (LSRs) (USDA FS and USDI BLM 1994). A watershed analysis has been completed for all watersheds located within LSRs on the Methow Sub-Basin. Specific direction and recommendations for road management are contained in the analysis documents (USDA FS 1998).

The Wenatchee National Forest Late-Successional Reserve Assessment (USDA FS1997) identified a goal of providing a "high" level of habitat effectiveness within LSRs. Levels of habitat effectiveness:

High: open road densities <1 mile/square mile of habitat and >70% security habitat (areas >500 miles from an open road or motorized trail)

Moderate: open road densities of 1-2 miles/square mile of habitat and 50-70% security habitat

Low: open road densities >2 miles/square mile of habitat and <50% security habitat.

These definitions will be used for the Methow Sub-Basin analysis.

C3. Riparian Dependent Wildlife Species

This group of wildlife species includes about 285 vertebrate species that are either directly dependent on riparian habitat or use these habitats far more than others (Thomas et al. 1979). Current management direction includes managing riparian areas and influence zones through a network of riparian reserves (USDA FS 1994). Riparian reserves provide habitat for wildlife species and are also important in providing habitat connectivity between areas managed for late-successional habitats. Table 1 summarizes the road-associated factors that can affect riparian-dependent wildlife species.

C4. Ungulates

These species include mule deer, elk, and mountain goats. Current management is focused on maintaining or restoring habitat effectiveness within areas designated as winter range (Northwest Forest Plan Allocation EW-1). Table 1 summarizes the road-associated factors that affect these species. An important issue addressed in this assessment is the access that roads provide on winter ranges for snowmobiling and other winter activities. Winter is an important time for ungulates because food resources are limited and energy reserves are at or below maintenance levels (McCorquodale 1991). This assessment was based on the assumption that the road density on the winter ranges provides an index to the amount of winter human activity that occurs. Should discrepancies exist between Forest Plan mapped winter range and actual winter range, this portion of the analysis will be conducted based on actual known winter range.

C5. Unique Habitats

Unique habitats include wetlands, talus slopes, caves, cliffs, snag patches, hardwood forests, meadows, etc., which provide important habitat for a wide variety of wildlife species. Unique habitats such as wetlands have special protection under the Northwest Forest Plan (USDA FS and USDI BLM 1994) and are managed by retaining buffers around them. Other unique habitats are managed on a site-specific basis through project design. Table 1 shows the road-associated factors that can affect unique habitats.

An accurate, mapped information layer of the unique habitats in the Methow Sub-Basin was unavailable at the time of this report. For this analysis, ratings were based on the local knowledge of the resident biologists. Due to the necessary level of detail, a priority has been determined to map the unique habitats prior to the watershed analysis.

Chewuch Watershed

A. Human Use

A1. Public Use

There is a variety of human use in the Chewuch Watershed. There are eight developed campgrounds and numerous dispersed camping sites along the Chewuch and Eightmile Rivers. The four trailheads are some of the heaviest used access points into the Pasayten Wilderness. There are several mining claims in the watershed, and a few summer homes. The heaviest use occurs in the summer; however this area is also very popular for deer hunting (general firearm and high hunt) in the fall and snowmobiling in the winter.

The Boulder Creek Road (3700000) is used as a through route to the town of Concunully. It also intersects with the Tiffany Mountain Road (3900000), which leads to the Tiffany campground and trailhead on the Tonasket Ranger District.

There are no developed campgrounds along the East Chewuch Road (5010000), but there are summer homes and dispersed camping sites. This road receives higher use by woodcutters, because the land it accesses is covered by PACFISH, providing more opportunities for firewood gathering as compared to the west side of the watershed.

The West Chewuch Road (5100000 and 5160000) is used heavily by recreationists all year. There are four developed campgrounds and many dispersed camping sites along the road. The Andrews Creek, Lake Creek, and Thirtymile Creek trailheads, all accessed by this road, are popular starting points for backpacking and horseback trips into the Pasayten Wilderness. There are also some small, less used trailheads along the roads. The Eightmile Road (5130000), which branches off 5100000, has five campgrounds, many dispersed sites, and the Billygoat Trailhead. The Billygoat trail is another major access route into the Pasayten Wilderness.

The Falls Creek Road (5140000) also branches off the West Chewuch, but receives less use than the Eightmile Road. There are no developed recreation sites, and few dispersed sites. Hunters use the road in the fall, and some people travel to the end of the road to hike up the Falls Creek trail, although the trail is not maintained regularly.

The Cub Creek Road (5200000), Cub Pass Road (5220000), and Rendevous Pass Road (5215000) receive a moderate amount of use. There are no developed campsites or trailheads along the roads, but there are many dispersed campsites that are used mostly during the fall hunting season. These roads are popular mountain bike routes in the summer. This is also a popular firewood cutting area.

A2. Resource Management

The Chewuch Watershed is a U-shaped valley with agricultural land, meadows, and ponderosa pine and Douglas-fir stands in the valley bottoms. The vegetation gradually changes to sub-alpine stands as elevation increases. Fire suppression over the past 90 years and selective timber harvest have caused a decrease in the amount of ponderosa pine and an increase in the more insect- and disease-prone Douglas-fir. The vegetation is used for lumber, Christmas trees, grazing for livestock, firewood, and many other products. Two entire livestock grazing allotments and portions of six others lie within the watershed.

Much of the vegetation in the Chewuch Watershed is advancing toward a late seral condition, thereby placing much of the watershed outside the historic range of variability. Most of the watershed was historically under a high frequency, low intensity fire regime. Close to 100 years of fire suppression and targeted timber harvest have changed the regime to a range of moderate to very high hazard and damage.

Various species of noxious weeds are growing along all the arterial and collector roads in the watershed. The most dominant species are spotted and diffuse knapweed.

The information for this section was obtained from the Chewuch Watershed Analysis, 1994, Methow Ranger District, Okanogan National Forest.

B. Aquatics

The Chewuch River enters the Methow River at Winthrop, Washington. The headwaters of the Chewuch reach almost to the Canada-United States border. Within the Chewuch Watershed are approximately 15,000 acres of private land, 5,000 acres of Washington Department of Fish and

Wildlife land, and 320,000 acres of National Forest land. Management direction in the Chewuch is divided between the Northwest Forest Plan and the PACFISH interim strategy. Under both management scenarios the Chewuch is considered a Key Watershed. Sub-watersheds include Lower Chewuch River Mainstem, Boulder Creek, Cub Creek, Falls Creek, Twenty Mile Creek, Thirty Mile Creek, Dog Creek, Windy Creek, Lake Creek, Andrews Creek, and Upper Chewuch River.

B1. Geologic Hazard – Score 6

The Chewuch Watershed is within the Cascades Highlands Subsection. This subsection is composed predominately of igneous intrusive rocks such as grandiorite, tonalite, and granite. The primary geomorphic processes that have influenced landscape development include alpine and continental that was followed by glacial fluvial erosion. The Chewuch drainage and major tributaries were overstepped and eroded, forming very steep rocky slopes. The uplands were over-ridden by ice caps and have a rolling topography.

The dominant landforms of interest are the glacial troughs that have a dense pattern of incised parallel first-order drainages. Glacial trough walls within the Cascades Highlands Subsection are natural high sediment producers. The major sources of sediment are delivered by shallow debris slides that occur along the troughs. These slides originate in the first-order drainages and are composed of coarse sandy to bouldery alluvium. These incised first-order drainages route debris to valley bottoms, forming fans which often confine stream systems in upper valleys and strongly control alignment and gradient in mid valley sections. Sediment is delivered directly from the debris slides and indirectly from stream channel adjustments. Streams continue to readjust to the confinement generated by the slides by: eroding the toe of alluvial fans; shifting alignment trigger bank scouring; and increasing gradient immediately downstream of fans triggering channel bed scour.

Soils within the watershed are typically coarse textured and are cobbly due to weathered bedrock or glacial till. Volcanic ash occurs in varying thickness due to differential erosion. Soil surfaces are typically erosive due to surface textures and slope gradients.

Roads can accelerate the natural rate of sediment delivery by:

1. Reducing slope strength triggering slope failures.
2. Canalizing or concentrating runoff on road prisms/cutslopes/fillslopes.
3. Adding to the amount of material composed in debris slides.
4. Causing confinement of channels forcing streams to erode channels and banks.

All four of these routing conditions occur within the Chewuch watershed.

B2. Road-Related Fine Sediment – Score 9

The Chewuch Watershed has naturally high rates of fine sediment delivery. However, roads and recreation along riverbanks are increasing sediment delivery in the lower 19 miles of the watershed. The lower watershed is considered to be functioning at risk with roads contributing to accelerated sediment. Actual road density values in most sub-watersheds are relatively high, coupled with the naturally high erosiveness of the watershed, and result in increased sedimentation, interference with infiltration and subsurface flow, accelerated runoff into the

stream channels, compaction, rilling, debris flows and landslides. Management activities including the road system in the Eightmile, Falls, Boulder, Twentymile, Doe, and Cub Creek Watersheds are believed to be contributing to accelerated sediment delivery. While instream fine sediment levels appear to be high in the upper watershed, there has been little management activity that would explain the sediment levels; the upper watershed is considered to be functioning appropriately.

B3. Floodplain Function, Off-Channel Habitat and Riparian Reserves - Score 9

Most of the floodplain within the watershed is functioning appropriately with the exception of sections on the alluvial fans of Farewell, Twentymile, and Boulder Creeks. Portions of the tributary channels were channelized after 1972 floods to protect road crossings, resulting in increased channel scour in the tributaries and Chewuch. A beaver-induced wetland on the Twentymile fan was also lost. Work was initiated in 1997 to reestablish more natural flow patterns across the Twentymile fan. Roads parallel both sides of the lower 25 miles of the Chewuch. Most of Cub, Boulder, Eightmile, Falls and the lower two miles of Lake Creek have valley bottom roads. There are about 160 miles of road within 200 feet of streams.

The lower 19 miles of the mainstem Chewuch is considered to be functioning at risk for off-channel habitat because the river has abandoned some backwater habitat and side channels. There appears to be less active off-channel habitat than under historic conditions, possibly partially due to removal of woody debris, road encroachment, and riprap. Upstream of Twentymile the Chewuch is considered to be functioning appropriately with numerous side channels and wetlands.

Riparian reserves are functioning appropriately with some functioning at risk sections. At-risk sections are due to roads or timber harvest which have removed barriers to livestock and allowed the livestock to access riparian reserves. Dispersed recreation is also impacting riparian habitat, wood recruitment and contributing to bank erosion. An ongoing restoration program is being implemented to minimize and/or avoid cattle and recreation impact on riparian reserves.

The watershed score is a nine because of valley bottom roads, the localized impacts of roads on alluvial fans, loss of off-channel habitat and riparian impact due to dispersed recreation.

B4. Flow Effects – Score 6

Most of the sub-watersheds and the mainstem Chewuch River are either functioning at risk or functioning at unacceptable risk regarding road densities. Actual road density values in most sub-watersheds are relatively high, and, coupled with the naturally high erosiveness of the watershed, result in increased sedimentation, interference with infiltration and subsurface flow, accelerated runoff into the stream channels, compaction, rilling, debris flows and landslides. First consideration for closure should be given to roads in floodplains, the sub-watersheds with the highest density and greatest erosive potential, and any specific sites already known to be contributing sediment. First consideration for closure should be given to roads in floodplains, the sub-watersheds with the highest density and greatest erosive potential, and any specific sites already known to be contributing sediment. Irrigation diversions are primarily responsible for the

change in peak/base flows functioning at unacceptable risk. The score is 6 because most of the upper watershed is unroaded and peak flows on a watershed scale are not felt to have been changed due to roads.

B5. At-Risk Fish - Score 9

The Chewuch Watershed provides important habitat for several at-risk fish populations with multiple significant sub-watersheds. Lake Creek is a significant sub-watershed for bull trout; Upper and Lower Chewuch are significant for spring chinook salmon; and Lower Chewuch is significant for steelhead. "Functioning at risk" habitat conditions in the lower Chewuch, along with irrigation withdrawals and depressed fish populations, prevent the Chewuch from being refugia. However, because of active restoration of roads, riparian habitat and ongoing irrigation practices, the Chewuch is a priority for restoration in the Methow Sub-Basin. The score is therefore 9. On-going efforts to reduce management impact to riparian habitat, reduce road impact, and improve flows should help improve habitat conditions. For the above reasons the Chewuch is a priority for watershed protection and restoration.

Existing habitat conditions were obtained from the most recent environmental baseline established in the "Thirty-Mile Bridge Replacement Biological Assessment 6/05/2001," and Chewuch Watershed Aquatic Species Biological Assessment for New and Ongoing Projects 09/07/2000.

C. Wildlife

C1. Wildlife: Upper Chewuch River Watershed

The Upper Chewuch River Watershed is located on the northeast side of the Sub-Basin and is moderately sized (143,320 acres). A majority of the land within the watershed is designated wilderness. Approximately one-quarter of the watershed is outside of wilderness and contains roads. This watershed provides high quality wildlife habitat but is also frequently used by humans. Therefore, the potential to improve habitat is moderate.

C1.a. Wide-Ranging Carnivores

Core habitat is abundant in the Upper Chewuch River Watershed. The current open road density is very low at 0.11 mi/mi^2. Approximately 94.4% of the watershed is core habitat, for a total of 135,249 acres. Portions of eight Lynx Analysis Units (LAUs) are located within the Upper Chewuch River Watershed (with areas >0.1 sq. mile). Table 2 describes the road density of those portions within the Upper Chewuch River Watershed. For descriptions of each LAU see Appendix C.

Table 2. Road density Lynx Analysis Units within the Upper Chewuch River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Andrews Creek	0	34.0	0
Apex Mt.	0	35.0	0

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Bald Mt.	0	0.8	0
Farewell Peak	9.9	25.8	0.4
Halfmoon Lake	2.2	43.5	0.1
Horseshoe Creek	0	26.3	0
Nanny Goat Mt.	0	0.3	0
Thirtymile Peak	1.7	10.7	0.2

Mean Road Density = 0.1 mi/mi^2

C1.b. Late-Successional Associated Wildlife Species

A small, 5,785-acre (4.1%) portion of the Upper Methow River LSR is located within the Upper Chewuch River Watershed. The road density within this LSR is 0.5 mi/mi^2, resulting in high habitat effectiveness with regard to road density.

C1.c. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 12,082 acres (8.4%) of the Upper Chewuch River Watershed and have a low open road density of 0.5 mi/mi^2.

C1.d. Ungulates

The Upper Chewuch River Watershed is not important to ungulates for winter range.

C1.e. Unique Habitats

The Pasayten Wilderness area of the Upper Chewuch River Watershed has abundant high elevation lakes, meadows, talus, and cliff habitat. Wet deciduous habitats also occur in the Twentymile, Horseshoe, and Tungsten areas.

C2. Wildlife: Lower Chewuch River Watershed

The Lower Chewuch River Watershed covers a large area (191,262 acres). Road densities are moderate, but this watershed experiences extremely heavy human use. The human activity level within this watershed may limit opportunities for improvement.

Note: In this discussion, numbers presented in (%) are a percentage of the corresponding watershed acreage.

C2.a. Wide-Ranging Carnivores

The open road density in the Lower Chewuch River Watershed is moderate at 1.64 mi/mi^2. Approximately 47.5% of the watershed is core habitat, for a total of 90,919 acres. Portions of seven Lynx Analysis Units (LAUs) are located within the Lower Chewuch River Watershed (with areas >0.1 sq. mile). Table 3 describes the road density of those portions within the Lower Chewuch River Watershed. A description of each LAU is available in Appendix C.

Table 3. Road density of Lynx Analysis Units within the Lower Chewuch River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Big Craggy Peak	67.7	39.7	1.7
Blue Buck Ridge	0.5	3.1	0.2
Farewell Peak	27.7	34.6	0.8
Middle Fork Boulder Creek	20.1	34.6	0.6
North Fork Boulder Creek	27.1	18.2	1.5
Whiteface Creek	0.2	0.2	1.0
Yarrow Creek	5.1	21.1	0.2

Mean Road Density = 0.9 mi/mi^2

C2.b. Late-Successional Associated Wildlife Species

The 3,128-acre (1.6%) Nice LSR and approximately 27,198 (14.2%) acres of the Upper Methow LSR are located in the Lower Chewuch River Watershed. The road density within the Nice LSR is high at 2.7 mi/mi^2, while the road density within the Upper Methow LSR is low at 0.5 mi/mi^2. With regard to road densities, the habitat effectiveness is low for the Nice LSR and high for the Upper Methow LSR.

C2.c. Riparian Dependent Wildlife Species

Although riparian reserves occupy only approximately 18,775 acres (9.8%) of the Lower Chewuch River Watershed, the open road density within the reserves is high, 2.9 mi/mi^2.

C2.d. Ungulates

The Lower Chewuch River Watershed provides a relatively large mapped ungulate winter range (EW-1) of 15,269 acres (8.0%). The road density within this winter range is also high, 2.4 mi/mi^2. Deer also heavily use many areas within the watershed for spring and summer range, and for fawning.

C2.e. Unique Habitats

Some small ponds, meadows and wetlands occur in the Lower Chewuch River Watershed. Cliffs and talus are present in the upper elevations of Eightmile Creek. One small cave can be found, but no other caves have been identified. Small, linear hardwood patches are present primarily along creeks, in each watershed on the district. Boulder Creek has abundant wet deciduous habitat. Snag habitat is increasing due to the presence of insect activity in the drainage. Western pine beetles are creating large snag patches in lodgepole stands in Falls Creek and other areas.

Upper Mainstem Methow Watershed

A. Human Use

A1. Public Use

Recreation is the predominant human activity in the watershed. Most is concentrated along Harts Pass Road (5400000) in the non-snow months, and the Black Pine Basin in the winter. It is estimated that from 60,000-80,000 people visit the watershed yearly. The watershed offers a broad spectrum of recreation activities ranging from rock climbing in early spring, to high hunt in fall, to helicopter skiing in winter.

Harts Pass Road winds its way along a spectacular cliff-hanging route to Harts Pass at 6,206 feet. The road continues out of the watershed up to near the summit of Slate Peak at 7,640 feet. This is the highest road in the state of Washington. Another fork of this road leads out of the watershed to the old mining areas of Chancellor and Barron. The road serves trailheads for the Pacific Crest Trail, and other trails leading into the Pasayten Wilderness. There are four developed campgrounds, and some dispersed camping sites along the road. The road is traveled by 100 to 200 vehicles on summer weekends. Actual traffic counts in 1990 and 1991 for the season were 11,239 and 8.599. Traffic counts on the lower portion of the road along the Methow River were 16,493 and 19,507, respectively. Approximately 4,000 people per season are contacted by Forest Service personnel at Harts Pass. Mountain bikers like to descend the Harts Pass road. Snow keeps Harts Pass closed until late June. It is accessible for snowmobiling in the fall and spring, but not in the winter because of the high danger of avalanches.

The Blackpine Basin, accessed by Blackpine Basin Road (5225000), receives much less use, although it is a very popular snowmobile route in the winter and during the fall hunting season. This road is a popular mountain bike route, and is used by people driving for pleasure.

There are no mining claims in the watershed.

A2. Resource Management

About 20% of the Upper Methow Watershed supports mature or old-growth stands. Most of these are upper elevation spruce and subalpine fir, with some mixed conifer and mature ponderosa pine. About 40% of the watershed supports pole-sized stands (less than 16-inch average diameter), and about 10% consists of lodgepole pine in a range of size classes (generally less than 16 inches). About 30% of the watershed is non-forest. This includes the lowest elevation sites that support shrublands, agriculture, and residential areas, and the highest elevation sites that support alpine vegetation.

Weather influences stand development mainly by moisture availability, regeneration success, and length of growing season. As elevation increases, precipitation increases and growing season decreases. In lower elevation, (below 4,500 feet) precipitation averages 15 to 20 inches annually. Stands of drought-tolerant ponderosa pine developed under a frequent, low-intensity fire regime with a fire return interval of between 7 and 25 years. Thirty-seven percent of the Upper Mainstem Methow is made up of the ponderosa pine and dry Douglas-fir plant association groups (PAGs). Ponderosa pine is the dominant species and mature stands were maintained by frequent fire historically. These PAGs dominate in the dry and warm dry biophysical environments. Since fire exclusion, these stands have become overstocked and stagnant, predisposing them to pine beetle attacks. Ponderosa pine and Douglas-fir dry PAGs make up

37% of the watershed, and 19% of this watershed is currently at high risk to pine beetle outbreaks.

There are portions of several grazing allotments located within the watershed. The Goat Cattle allotment includes all of the Blackpine Basin. The Harts Pass sheep allotment uses a portion of the watershed every other year.

Noxious weeds are growing along Harts Pass and Blackpine Basin roads, although populations are less concentrated than in other parts of the Methow Valley Ranger District.

The information for this section was taken from the Upper Methow Watershed Analysis, 1998, Methow Valley Ranger District, Okanogan National Forest.

B. Aquatics

The Upper Methow watershed includes that portion of the Methow sub-basin upstream from and including Goat Creek, but excluding Early Winters and Lost River, which are considered separate watersheds. The downstream extent of the watershed is approximately 10 miles northwest of Winthrop, Washington. Approximately 95% of the 104,550-acre watershed is National Forest land. Approximately 4,000 acres are private lands, primarily along the Methow River. Other than about 12,600 acres within the Pasayten Wilderness, the National Forest lands are managed as LSR. Bull trout, steelhead, and spring chinook salmon are found in the watershed. Sub-watersheds include, Little Coulder Creek, Goat Creek, Upper Methow River Mainstem, West Fork Methow River, Rattlesnake Creek, Robinson Creek.

B1. Geologic Hazard – Score 6

The Upper Methow Watershed is within the Middle Methow Subsection. This subsection is composed predominately of volcanic and mixed metamorphic, and igneous intrusive rocks. The primary geomorphic processes that have influenced landscape development include alpine and continental that was followed by glacial fluvial erosion. The major tributaries to the Methow were overstepped and eroded forming very steep rocky slopes typically with relatively broad U-shaped valleys.

The dominant landforms of interest are the glacial troughs that have a dense pattern of incised parallel first-order drainages. Glacial trough walls within the Middle Methow Subsection are natural high sediment producers. The major sources of sediment are delivered by shallow debris slides that occur along the troughs. These slides originate in the first order drainages and are composed of coarse sandy to bouldery alluvium. These incised first order drainages route debris to valley bottoms, forming fans which often confine stream systems in upper valleys and strongly control alignment and gradient in mid valley sections. Sediment is delivered directly from the debris slides and indirectly from stream channel adjustments. Streams continue to readjust to the confinement generated by the slides by eroding the toe of alluvial fans, shifting alignment trigger bank scouring, and increasing gradient immediately downstream of fans triggering channel bed scour.

Roads can accelerate the natural rate of sediment delivery by:

1. Reducing slope strength, thereby triggering slope failures.
2. Canalizing or concentrating runoff on road prisms/cutslopes/fillslopes.
3. Adding to the amount of material composed in debris slides.
4. Causing confinement of channels, thereby forcing streams to erode channels and banks.

All four of these routing conditions occur within the watershed.

B2. Road Related Fine Sediment – Score 3

The Upper Methow is functioning appropriately for fine sediment overall; however, portions of the watershed at functioning at risk: Goat Creek, Gate Creek, and the mainstem Methow below the confluence with Early Winters Creek. Most of the watershed is unroaded and land management has not influenced sediment delivery processes. High road densities in the Goat, upper Gate Creek and Goat Wall sub-watersheds, and bank erosion downstream of early Winters Creek, are believed to be accelerating sediment delivery to aquatic habitat. The score is 3 because roads are an important contributor to fine sediment in the lower watershed but the overall effects to the watershed are low.

B3. Floodplain Function, Off-Channel Habitat and Riparian Reserves – Score 3

Floodplain function is functioning appropriately except for Goat Creek and portions of the mainstem Methow in the vicinity of Robinson Creek, which are functioning at risk. The alluvial fan of Goat Creek has been channelized, thereby preventing overbank flows onto floodplain and restricting channel movement across the fan. Portions of the mainstem Methow have been rip-rapped and channelized, diminishing floodplain connectivity with the stream. Off-channel habitat has been affected in a similar manner.

Riparian reserves are functioning appropriately throughout most of the watershed. Goat Creek sub-watershed is functioning at risk due to riparian roads, timber harvest, and grazing. Just downstream of the confluence with the Lost River, riparian reserves have been adversely impacted by riprap, flood control dikes, agricultural clearing, grazing, firewood cutting, and residential development. Dispersed camping in the riparian reserve is a concern on the mainstem Methow between Lost River and Trout Creek. Score is 3 since most of the watershed is functioning appropriately, the impact is primarily localized and not all riparian/floodplain impact is a direct result of National Forest roads.

B4. Flow Effects – Score 3

Overall, roads are not a major impact in the watershed, with the exception of Goat Creek sub-watershed (road density 5 miles/sq.mi) and in the Blackpine and Gate drainages. These small drainages contribute only a small percentage of the Methow stream flow. There are no open roads in 79% of the watershed. There is a valley bottom road adjacent to the Methow but it is a county road. The primary impact on flows is not related to roads but to irrigation and wells; therefore the score is 3.

B5. At-Risk Fish – Score 6

The Upper Methow Watershed contains important habitat for at-risk fish. Bull trout, spring

chinook, and steelhead are found in the watershed. The Upper Methow Mainstem, West Fork Methow, and Goat are significant sub-watersheds for bull trout.

Existing habitat conditions were obtained from the most recent environmental baseline established in "Upper Methow Watershed Aquatic Species Biological Assessment for New and Ongoing Projects," January 25, 2002.

C. Wildlife

The Upper Methow River Watershed is the smallest watershed in this analysis (120,638 acres). Located on the northwest side of the sub-basin, this watershed borders wilderness lands and provides high quality wildlife habitat. However, a major highway and a very high use recreational road bisect the watershed. Therefore, the potential to improve habitat is moderate.

C1. Wide-Ranging Carnivores

Core habitat is abundant in the Upper Methow River Watershed. The current open road density is low at 0.38 mi/mi^2. Approximately 83.2% of the watershed is core habitat, for a total of 100,323 acres. Portions of eight Lynx Analysis Units (LAUs) are located within the Upper Methow River Watershed (with areas >0.1 sq.mile). Table 4 describes the road density of those portions within the Upper Methow River Watershed. For descriptions of each LAU, see Appendix C.

Table 4. Road density of Lynx Analysis Units within the Upper Methow River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Buckskin Ridge	0	0.2	0
Crescent Mt.	0	0.4	0
Eureka Lake	0	17.3	0
Granite Creek	0	0.1	0
Hancock Ridge	9.3	59.6	0.2
Mazama	18.8	52.8	0.4
Sandy Butte	5.4	31.1	0.2
Whiteface Creek	17	10.6	1.6

Mean Road Density = 0.3 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A majority of the Upper Methow River LSR is located within the Upper Methow River Watershed. About 76,481 acres cover 63.4% of the watershed. The road density within this watershed is low, at 0.5 mi/mi^2. The habitat effectiveness, based on road density, is high.

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 14,550 acres (12.1%) of the Upper Methow River Watershed and have a low open road density of 0.6 mi/mi^2.

C4. Ungulates

This watershed tends to be important to ungulates, including deer and mountain goats, for spring and summer range and fawning.

C5. Unique Habitats

Some of the best cliff habitat on the district is in the Upper Methow River Watershed. Trout Creek, Brush Creek, Last Chance Point, Caloway Creek, Early Winters Creek, Lucky Jim Bluff, and Goat Wall have been identified as high quality cliff habitats. Rock/talus habitat is abundant in the watershed, especially in the Lost River and West Fork Methow River sub-drainages. Hardwoods are limited in the watershed. Some alpine and dry meadow habitat is present in Goat Creek. Snags are locally abundant in the area where the Whiteface Fire burned in 1996, and along the Highway 20 corridor. A Douglas-fir tussock moth outbreak is occurring in the watershed and will result in increased snag habitat in the future.

Middle Methow River Watershed

A. Human Use

A1. Public Use

This watershed includes most of the Methow River valley floor, where the majority of the people live, many of whom make their living off the land in orchards, field crops, and livestock. The National Forest System Land in the watershed includes some nearly untouched by humans (in the Lake Chelan-Sawtooth Wilderness) to areas with long histories of timber harvest (North and South Summits).

South Summit Road (4100000) has no developed campgrounds or trailheads. There are many dispersed campsites, used mostly during the fall hunting season. Benson Creek Road (4150000) connects the South Summit Road to Highway 153. This area is also used mainly during hunting season. The entire South Summit area is a popular firewood gathering area.

North Summit Road (4200000) accesses the Loup Loup campground, then continues on to Concunully. Loup Loup Ski Bowl, accessed by a spur road off the North Summit Road, has approximately 15,000 skier days each winter. Starvation Mountain Road (4235000) takes off from the North Summit Road and continues to Starvation Mountain. There are no developed campgrounds along this road. Beaver Creek Road (4225000) travels between North Summit Road and the Forest boundary to the west. Lightning Creek Road (4230000) comes off Beaver Creek Road. There are no developed recreation facilities along either of these roads. The entire North Summit area receives a fair amount of recreation, despite the limited number of developed recreation facilities. Hundreds of hunters camp and hunt throughout the area each fall. Mountain biking is becoming more popular along the roads and trails in the area. The North Summit area is also popular for gathering firewood and miscellaneous products.

Wolf Creek Road (5005000) accesses the Wolf Creek trailhead. This trail is a popular route into the Lake Chelan-Sawtooth Wilderness.

A2. Resource Management

This watershed is very diverse, because it covers such a large area. The size, species, and distribution of the vegetation is constantly changing in response to natural disturbances (such as wildfires, insects, diseases, and floods), natural processes (such as successional shifts in dominant species), and human activities (such as timber harvest, grazing, and fire suppression). The human activities have caused more rapid change in the vegetation since the turn of the century than the mostly unaltered ecosystem experienced for centuries before non-indigenous peoples began living here.

Timber harvest and a few large wildfires have reduced the amount of old forests, which covered most of the National Forest System lands in the early 1920s. Fire suppression has also changed the vegetation, allowing an increase in fire-intolerant vegetation, fuel on the ground, and ladder fuels reaching into the crowns of the dominant trees.

Young timber stands (where most trees are four to 14 inches DBH) tend to be the dominant forest cover type of the entire watershed. They cover an estimated 54,800 acres, which comprises about 40% of National Forest System Lands (NFSL) within the entire watershed. It appears that stands of young age have increased substantially since the 1920s' levels when they covered approximately 22% of the Watershed. Mature stands (where most trees are larger than 14 inches DBH) on the other hand, appear to have decreased from historic levels. In the mid-1980s, mature stands covered approximately 41,700 acres or about 31% of the watershed, compared to 55% in 1922.

Historic and current levels of immature stands (where trees are less than four inches DBH) are very close in comparison. Immature stands of seedlings and saplings covered about 4,400 acres or three percent of the watershed in the mid-1980s, compared to an estimated 5.000 acres, or 4% in 1922.

The Middle Methow Watershed contains ten range allotments on National Forest System Lands.

Noxious weeds grow along most of the arterial and collector roads in the Watershed. The most prevalent is diffuse knapweed.

The information for this section was taken from the Middle Methow Watershed Analysis, 1997, Winthrop, WA, Methow Valley Ranger District, Okanogan National Forest.

B. Aquatics

The 214,000-acre Middle Methow extends from the town of Carlton to the confluence of Goat Creek with the Methow River. Land ownership is approximately 130,600 acres National Forest, 400 acres of Washington Department of Wildlife land and 83,000 acres are privately owned. The valley floor is primarily privately owned and agricultural. The watersheds east of the Methow receive low levels of precipitation. Streams are small but cold and perennial because abundant tills provide high groundwater storage. Many of the streams do not have surface flow connectivity with Methow River and it is unknown if they did historically. Soils are highly erodible and road densities are high. High intensity summer storms can load the system with fine

sediments, which are transported in the spring. Although flows are low, chronic elevated sediment may have a cumulative effect on this reach of the Methow, which contains the bulk of the Methow's summer and fall chinook spawning.

Major sub-watersheds include Wolf, Beaver, and Benson.

B1. Geologic Hazard – Score 2

The Middle Methow Watershed is with the Cascade Highlands Subsection. This subsection is composed predominately of igneous intrusive rocks, such as grandiorite tonalite, and granite. The primary geomorphic processes that have influenced the landscape are alpine and continental glaciation followed by glacial-fluvial erosion and deposition. The upper watershed positions are rolling highlands. Within these areas fine to coarse grain sand has filled drainage-ways and depositional areas. Subsoils are also composed of fine-grained sandy material, which is erosive when exposed and unvegetated. There is a noticeable increase in slope gradient from upper watershed positions and mid and lower watershed positions. Continental ice scoured and over-steepened the mid-slope positions and glacial-fluvial scour downcut major drainage systems. Mass movement is not common in this watershed. However, soil material is highly erosive when vegetation is disturbed. High intensity storms have had a history of trigger stream systems to scour and down-cut. These fluvial actions have had a history of delivering fine to coarse sands downstream.

B2. Road-Related Fine Sediment – Score 6

Sub-watersheds within the watershed range from functioning appropriately (Wolf Creek) to functioning at unacceptable risk (Beaver Creek). Overall the watershed is rated as functioning at risk. Apparent accelerated fine sediment delivery to streams from roads is a primary reason fine sediment is rated as functioning at unacceptable risk in the Beaver Creek sub-watershed.

B3. Floodplain Function – Score 6

Watershed is scored as a 6. Roads have reduced floodplain connectivity especially in the Beaver sub-watershed. The Wolf Creek alluvial fan has been channelized. Dispersed recreation within riparian reserves is becoming an increasing problem in the Beaver Sub-Watershed (Jennifer Molesworth, Methow Valley Ranger District, personal communication).

B4. Flow Effects - Score 6

Overall, the Middle Methow watershed is functioning at risk for road density and location; however, the Beaver Sub-Watershed is judged to be functioning at unacceptable risk. Roads appear to be a major source of fine sediment and the drainage network is estimated to have increased by 32% due to roads in the Beaver Sub-Watershed.

B5. At-Risk Fish Populations – Score 6

The Middle Methow watershed is significant for spring Chinook salmon, steelhead, and summer Chinook salmon. Summer Chinook however are not listed under the Endangered Species Act. Wolf Creek is significant for bull trout. The watershed is not scored a 9 due to habitat problems in Beaver Creek; overall habitat conditions are judged to be functioning at risk. Much of the

habitat for at risk fish species is not on National Forest lands. Restoration programs on private and National Forest lands are being implemented in the Beaver Sub-Watershed.

Existing habitat conditions were obtained from the most recent environmental baseline established in "Draft Middle Methow Watershed Aquatic Species Biological Assessment for New and Ongoing Projects," May 2000.

C. Wildlife

The Middle Methow River Watershed covers a very large area (249,524 acres) and is bisected by a major highway. Human use is quite high throughout the year. A great deal of mixed ownership occurs throughout the watershed, including the towns of Winthrop and Mazama. There is potential for improvement within the watershed, although it may be limited by human use.

C1. Wide-Ranging Carnivores

The Middle Methow River Watershed has the highest open road density within the Methow Sub-Basin. The open road density is moderate at 1.78 mi/mi^2. Approximately 38.7% of the watershed is core habitat, for a total of 96,528 acres. Portions of seven Lynx Analysis Units (LAUs) are located within the Middle Methow River Watershed (with areas >0.1 sq.mile). The following table describes the road density of those portions within the Middle Methow River Watershed. For descriptions of each LAU, see Appendix C.

Table 5. Road density of Lynx Analysis Units in the Middle Methow River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Big Craggy Pk.	0.5	0.5	1.0
Blue Buck Ridge	51.6	38.8	1.3
Milton Mtn.	0	30.7	0
Sandy Butte	0.2	12.2	0.02
S. Fk. Beaver Ck.	76.7	30.6	2.5
W. Fk. Salmon Ck.	0.8	0.4	2
Whiteface Ck.	39.6	32.2	1.2

Mean Road Density = 1.2 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A small portion of the Twisp LSR, 41 acres (0.02%), lies within the Middle Methow River Watershed. A portion of the Upper Methow LSR is found within the Middle Methow River Watershed. The LSR covers approximately 38,883 acres (15.6%) of the watershed. The road densities within the LSRs are 0.8 and 0.5 mi/mi^2 respectively. These low road densities result in high habitat effectiveness for both LSRs.

C3. Riparian Dependent Wildlife Species

Riparian reserves are limited and occupy only 14,193 acres (5.7%) of the Middle Methow River Watershed. The open road density within the riparian reserves is high, 2.1 mi/mi^2.

C4. Ungulates

The Middle Methow River Watershed contains the greatest amount of mapped winter range within the Methow Sub-Basin. There are 46,914 acres (18.8%) of winter range on the east side of the watershed, with a moderate open road density of 1.6 mi/mi^2. Mountain goats can also be found on the northwestern portion of the watershed.

C5. Unique Habitats

The Middle Methow River Watershed has abundant small ponds and wetlands in the North and South Summit area. Meadows are present in each sub-watershed, but Wolf and Beaver Creeks have the most meadow habitat in the watershed. Hardwood patches are found primarily along the riparian areas, and are most notable in Benson and French Creek and the Fawn subdrainage. Cliff and talus habitats are found in the McClure Mountain and Grizzly Mountain areas. Douglas-fir tussock moth activity is increasing, and snag levels are increasing as a result, particularly in the Fawn subdrainage. Pine beetle activity is resulting in increased snag levels in Beaver Creek and other areas.

Lower Methow River Watershed

A. Human Use

A1. Public Use

The Lower Mainstem Methow Watershed includes the lower slopes of the Methow River valley. In this portion of the overall Methow Basin, the river carves a gorge as the valley narrows considerably in comparison to the broader floodplains and terraces from above Winthrop down to Carlton. The lower elevation land adjacent to the river is mostly private and is occupied by orchards, field crops, rangeland, and an increasing number of family residences. The National Forest System land in the watershed ranges from high mountain peaks in the Lake Chelan-Sawtooth Wilderness to the lower slopes of Black Canyon and Antoine Creeks.

Libby Creek Road (4300000) provides a route from Highway 153 to Blackpine Lake, and on to the Twisp River road. Along the portion within this watershed, the only developed recreation site is the Libby Lake trailhead. There are several dispersed camping sites that are used mostly during the fall hunting season. This road is also a groomed snowmobile trail. There is a substantial amount of private land within the Libby Creek drainage, all of which is accessed primarily by the Libby Creek road.

The North Fork Gold Creek road (4340000) connects into Libby Creek Road, and creates a popular driving and snowmobiling route. There is one campground, and two trailheads on side-roads off Gold Creek road. This area is used heavily by recreationists. An extensive trail system, open to motorized and non-motorized users, connects to trails on the Chelan Ranger District, and also provides access to the Lake Chelan-Sawtooth Wilderness. A groomed snowmobile trail provides access to Libby and Buttermilk Creeks. The road also provides access to private land along Gold Creek.

South Fork Gold Creek road (4330000) passes through private land, and continues up to the

boundary between the Chelan and Methow Valley Ranger Districts. There are no developed recreation facilities along the road.

Black Canyon Road (4010000) receives light to moderate dispersed use. Several dispersed camps exist along 4010000, used in the summer and fall. There are no developed sites along the road. A groomed snowmobile route along the road provides access to the Chelan groomed trails, and the Sawtooth Ridge and Cooper Mountain areas.

A2. Resource Management

Approximately 28% of the watershed is covered by stands of young timber, with trees of 4 to 14 inches DBH. Mature stands (with trees greater than 14 inches DBH) cover approximately 12%. Immature stands (with trees less than four inches DBH) cover approximately 4% of the watershed. The remainder is unforested. Decades of fire exclusion and timber harvest practices have changed much of the predominant trees size and stand canopy structure, from open ponderosa pine stands, to multi-canopied stands with scattered ponderosa pine, and dense understories of Douglas-fir.

Black Canyon, accessed by road 4010000, is an exception. The vegetation is almost completely the result of the Camas fire of 1929 and the Mitchell Creek fire of 1970. The burned north aspect areas in this sub-watershed have regenerated with mostly lodgepole pine. The remainder of the sub-watershed is a mixture of mostly young ponderosa pine that originated after the Camas fire and islands of mostly ponderosa pine or Douglas-fir that survived both fires. Most of the young stands are overstocked, stagnated lodgepole pine that need stocking control to increase growth. The stands of ponderosa pine are close to the size that makes them susceptible to bark beetle attack.

The Lower Methow Watershed contains seven range allotments. All the arterial and collector roads access allotment.

There are noxious weeds along all arterial and collector roads in the watershed. The most prevalent is diffuse knapweed, covering thousands of acres along roads and south-facing hillsides.

The information for this section was obtained from the Lower Methow Watershed Analysis, 1999, Okanogan National Forest, Methow Ranger District, Winthrop, WA.

B. Aquatics

The 245,000 acre Lower Methow Watershed extends approximately 30 miles. Approximately 146,000 acres are within the National Forest. The remaining 97,000 acres consist of mix ownership including private, state and Bureau of Land Management (BLM) lands. The non-Forest Service lands are primarily in the valley bottoms and flats next to major streams, the Methow and Columbia Rivers, and State Highways 97 and 153.

Elevation ranges from 8,464 feet at Hoodoo Peak in the northwestern corner (Libby Creek sub-drainage) to 792 feet near the Columbia River (Antoine South) on the southern side of the

watershed. A maximum difference of over 7,000 feet occurs from mountain peaks to the Columbia River.

Spring chinook salmon, summer chinook salmon, and steelhead are found throughout the mainstem Methow and in at least the lower reaches of tributaries. Bull trout are also found in the watershed. Sub-watersheds include: mainstem Lower Methow River, Libby Creek, Gold Creek, McFarland Creek, Squaw Creek, and Black Canyon Creek. All of the streams are west of the Methow River and are governed under the terms of the Northwest Forest Plan (USDA FS 1994).

B1. Geologic Hazard – Score 6

The Lower Methow Watershed is within the Okanogan Methow Lowlands Subsection. This subsection is composed predominately of thick deposits of glacial drift. The primary geomorphic processes that have influenced landscape development include alpine and continental depositions followed by glacial fluvial deposition.

The dominant landforms of interest are the glacial moraines and terraces, and outwash plains or benches. Soils often have sandy surfaces with varying degrees of cobbles. Vegetation is normally grasslands and open grown forest stands. Surface O horizons are very important for these soils because of the water-holding capabilities. Once the surface organic layer has been removed, vegetation recovery is adversely affected, increasing the risk of erosion. Roads can accelerate the natural rate of sediment delivery mostly by canalizing or concentrating runoff on road prisms/cutslopes/fillslopes.

B2. Road-Related Fine Sediment – Score 6

Sub-watersheds within the watershed range from functioning appropriately to functioning at unacceptable risk. Overall the watershed is rated as functioning at risk. Roads, along with grazing and timber harvest, appear to be contributing to accelerated sediment delivery; therefore, the score is 6.

B3. Floodplain Function, Off-Channel Habitat, and Riparian Reserves - Score 6

Many streams within the watershed are naturally confined, thereby restricting floodplain and off-channel habitat development. Overall the watershed is rated as functioning at risk for floodplains, off-channel habitat, and riparian reserves. Roads, private development and loss of beaver contribute to the “at risk” ratings. Private land developments, roads, timber harvest, grazing and, to some extent, recreation, have affected floodplains and riparian habitat. Dispersed recreation sites are currently not consistent with the ACS. However, other management activities have had greater impact; therefore, the score is 6.

B4. Flow Effects - Score 3

Change in Peak/Base flows is functioning at risk, primarily due to irrigation withdrawals (as opposed to roads). Overall the watershed is considered functioning at risk for road density and location with valley bottom roads and road related sediment impacting stream processes and habitat.

B5. At-Risk Fish - Score 6

Spring chinook salmon primarily migrate through the watershed with some rearing and possibly spawning in the lower reaches of tributary streams. Steelhead are likely present in perennial the sub-watersheds and the Lower Methow sub-watershed is considered to be significant for steelhead due to spawning and rearing. Bull trout sub-adults and adults utilize the mainstem Methow and a small population persists in the Gold Creek sub-watershed. Habitat connectivity between sub-watersheds and other watersheds is generally maintained but irrigation withdrawals are a concern.

Existing habitat conditions were obtained from the most recent environmental baseline established in the "Draft Lower Methow Biological Assessment," March 3, 2002.

C. Wildlife

The Lower Methow River Watershed is located on the southern end of the Methow Sub-Basin. This watershed covers a large area (238,394 acres) of multiple use land. Road densities are moderate; however, mixed ownership and human use limit opportunities for improvement.

C1. Wide-Ranging Carnivores

The open road density in the Lower Methow River Watershed is moderate, at 1.54 mi/mi^2. Approximately 44.3% of the watershed is core, for a total of 105,504 acres. Portions of four Lynx Analysis Units (LAUs) are located within the Lower Methow River Watershed (with areas >0.1 sq. mile). Table 6 describes the road density of those portions within the Lower Methow River Watershed. For descriptions of each LAU, see Appendix C.

Table 6. Road density of Lynx Analysis Units within the Lower Methow River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Cooper Mt.	20.8	20.5	1.0
Hungry Ridge	23.2	34.0	0.7
Methow Gold Creek	14.7	45.9	0.3
Spirit Mt.	0	0.2	0

Mean Road Density = 0.5 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A small, 6,198-acre, portion of the Hunter LSR occupies about 2.6% of the Lower Methow River Watershed. The road density within this LSR is moderate at 1.6 mi/mi^2. Approximately 51,806 acres (21.7%) of the Sawtooth LSR lie within the Lower Methow River Watershed. The road density within this LSR is low at 0.4 mi/mi^2. With regard to road densities only, the habitat effectiveness (HE) of the Hunter LSR is moderate, while the HE of the Sawtooth LSR is high.

C3. Riparian Dependent Wildlife Species

Although riparian reserves occupy only approximately 13,061 acres (5.5%) of the Lower Methow River Watershed, the open road density within the riparian reserves is high, at 2.0 mi/mi^2.

C4. Ungulates

The Lower Methow River Watershed contains a small amount, 4,347 acres (1.8%), of mapped ungulate winter range. The road density within winter range is moderate, 1.2 mi/mi^2. This area is a site of migration and spring and summer range, and is not particularly important as winter range.

C5. Unique Habitats

The Lower Methow River Watershed has some small wetlands, lakes and ponds, particularly near the Sawtooth Crest. Cliff and talus habitats also occur along the Sawtooth Ridge, Raven Ridge, Hungry Mountain, and Martin Peak. No caves have been identified. Some beetle activity has been identified in the Squaw Creek drainage, but has not yet resulted in snag patches.

Twisp River Watershed

A. Human Use

A1. Public Use

The Twisp River Watershed is one of the more heavily used recreation areas on the Methow Valley Ranger District. The roaded area along the valley bottom is surrounded by the Lake Chelan-Sawtooth Wilderness. The watershed provides the setting for a wide variety of recreational activities. Among the most popular are dispersed camping, hiking, horseback riding, gathering forest products, fishing, hunting, sightseeing, and driving for pleasure. Dispersed and developed camping have been popular activities in the Twisp River watershed since the area became roaded during the first large timber harvests in the 1950s and 1960s. Very little firewood cutting or other special product gathering occurs in the watershed, because most of it is Wilderness or designated as LSR by the Northwest Forest Plan.

Roads run along the north and south sides of the Twisp River. There are five campgrounds and five trailheads along Twisp River North road (4400000 and 4440000). The area is popular in the summer and fall for hunting, hiking, and camping, and in the winter for cross-country skiing and snowmobiling. Road 4400000 passes through private property on the western-most end. There is an unpatented mining claim in North Creek, accessed by these roads.

Twisp River South Road (4420000, 4430000, and 4435000) forms a groomed snowmobile route with Twisp River North Road. There is one developed campground and five trailheads accessed by this road. The trails are used consistently through the summer and fall. Road 4420000 provides access to private property on its western-most end. A patented mining claim along South Creek is accessed by these roads.

Buttermilk Road (4300000) travels up and over a pass into the Libby Creek sub-drainage (that portion of the road is discussed in the Lower Mainstem Methow Watershed section later in this

report). One of the most popular campgrounds on the Methow Valley Ranger District, Blackpine Lake, is located along this road. There is also one trailhead accessed by 4300000 in the Twisp River Watershed. Blackpine Lake campground is full, or nearly full, most of the summer and fall. There are many dispersed campsites along this road. These are mostly used during the fall hunting season.

Thompson Ridge Road (4410000) is a through route between the Twisp River Watershed and the Middle Methow Watershed. There are no developed campgrounds or trails along the road, but the area receives dispersed use, especially during the fall hunting season.

A2. Resource Management

Nearly half of the Twisp River Watershed, including the headwaters and much of the uplands, is included in the Lake Chelan-Sawtooth Wilderness. Most of the land outside the Wilderness is designated as late-successional reserve. The Thompson Ridge area, accessed by 4410000 is designated as matrix, and has opportunities for timber management. Douglas-fir now dominates many sites where ponderosa pine was the prevalent overstory tree species before fire suppression. The watershed currently includes all or portions of five livestock grazing allotments.

Noxious weeds are present along all the arterial and collector roads in the watershed.

The information for this section was taken from the Twisp River Watershed Analysis, 1995, Okanogan National Forest, Methow Valley Ranger District, Winthrop, WA.

B. Aquatics

The thirty mile long, approximately 157,000-acre, Twisp River Watershed drains into the Methow River near the town of Twisp. About 90% of the watershed lies within the Okanogan-Wenatchee National Forest. Almost one-half of the watershed, 72,000 acres, is within the Chelan-Sawtooth Wilderness. An additional 30,000 acres is managed as LSR. The Twisp River is a Key Watershed. While much of the watershed is in wilderness or managed for late successional habitat, past land management has had an impact on aquatic habitat, primarily in the lower watershed. The presence of brook trout in the watershed raises concerns for the long-term status of the bull trout population.

Spring chinook salmon, summer steelhead, and bull trout access nearly the entire 30 miles of the Twisp River although natural (and man-made) barriers limit migratory fish access to many tributaries. Sub-watersheds are the Lower Twisp River Mainstem, Mainstem Upper Twisp River, Upper Twisp River, Poorman Creek, Canyon Creek, Little Bridge Creek, Butter Milk Creek, Eagle Creek, War Creek, South Creek, and North Creek.

B1. Geologic Hazard – Score 2

The Twisp Watershed is within the Middle Methow Subsection. This subsection is composed predominately of volcanic and mixed metamorphic, and igneous intrusive rocks. The primary geomorphic processes that have influenced landscape development include alpine and continental glaciation followed by glacial fluvial erosion. The Twisp drainage and the major

tributaries to the Methow were overstepped and eroded forming very steep rocky slopes typically with relatively broad U-shaped valleys. The exception is Lost River which has a pronounced V-shape formed by excessive glacial fluvial erosion.

The dominant landforms of interest are the glacial troughs that have a dense pattern of incised parallel first order drainages. Glacial trough walls within the Middle Methow Subsection are natural high sediment producers. The major sources of sediment are delivered by shallow debris slides that occur along the troughs. These slides originate in the first order drainages and are composed of coarse sandy to bouldery alluvium. These incised first order drainages route debris to valley bottoms forming fans which often confine stream systems in upper valleys and strongly control alignment and gradient in mid valley sections. Sediment is delivered directly from the debris slides and indirectly from stream channel adjustments. Streams continue to readjust to the confinement generated by the slides by: eroding the toe of alluvial fans, shifting alignment trigger bank scouring, and increasing gradient immediately downstream of fans triggering channel bed scour. Most of the debris slides occur in upper portions of unroaded watersheds. Roaded portions of watershed have lower sediment delivery and routing risks.

Soils within the watershed are typically coarse textured and are cobbly due to weathered bedrock or glacial till. Volcanic ash occurs in varying thickness due to differential erosion. Soil surfaces are erosive due to surface textures and slope gradients. Ground vegetation often is dense enough to help trap and stabilize eroded material.

Roads can accelerate the natural rate of sediment delivery by:

1. Reducing slope strength, thereby triggering slope failures.
2. Canalizing or concentrating runoff on road prisms/cutslopes/fillslopes.
3. Adding to the amount of material composed in debris slides.
4. Causing confinement of channels, thereby forcing streams to erode channels and banks.

All four of these routing conditions occur within the watershed.

B2. Road-Related Fine Sediment – Score 6

The upper Twisp Watershed, above the Buttermilk Creek confluence, is functioning appropriately for fine sediment. From Buttermilk Creek downstream the watershed, including tributaries, is functioning at unacceptable risk. While no quantitative sediment is available, naturally high sediment delivery rates appear to have been accelerated by valley bottom road locations, recent road failures and bank erosion that may be the result of human caused changes to stream hydrology and the drainage network. Human-generated fine sediment sources in the watershed are the greatest in the Little Bridge Watershed and are due mainly to valley bottom road locations, recent road failures in the spring of 1996, and bank erosion possibly due to human-caused changes in stream hydrology and drainage network. This receives a score 6 because the upper portion of the watershed is functioning appropriately but roads are believed to be contributing to accelerated erosion in the lower watershed.

B3. Floodplain Function, Off-Channel Habitat, Riparian Reserves – Score 6

Twisp Watershed above Little Bridge Creek is functioning appropriately for floodplain

connectivity and off-channel habitat. Twisp Watershed from Little Bridge Creek down is functioning at risk.

On National Forest lands, the Twisp River has well-connected floodplains and side channels. Roads, agriculture, rural development, removal of riparian vegetation, and other floodplain impacts on the private land in lower Twisp Watershed have reduced floodplain connectivity and possibly placed the system at risk. No data has been gathered on the extent of loss in connectivity along private lands.

Buttermilk Creek is a confined, high gradient system with limited floodplain development as the natural condition. However, it appears that channelization of Buttermilk Creek fan may have reduced some off-channel habitat and prevents the alluvial fan from functioning.

In Little Bridge Creek the channel has been cut off from historic side channels, beaver ponds, and riparian wetlands.

Riparian reserves in the non-wilderness portion of the watershed are functioning at risk and portions of Little Bridge Creek are functioning unacceptable risk. Riparian habitat conditions adjacent to important spring chinook salmon and bull trout spawning areas are generally in good to excellent conditions. The watershed is considered functioning at risk due to past selective timber harvest, grazing, valley bottom roads, and some localized concerns about dispersed recreation adjacent to important bull trout habitat in the Twisp River.

B4. Flow Effects – Score 3

Fifty percent of the Twisp Watershed is within wilderness and thus is functioning appropriately for road density and location. With 220 miles of road and 530 stream crossings the watershed as a whole is considered to be functioning at risk. The lower 26 miles of the mainstem Twisp River are bounded on both sides by road. However, floodplains are not impacted and the stream is free to migrate across the floodplain, at least on National Forest land. Road densities, location, and sediment from roads are of particular concern in Little Bridge Creek and Buttermilk Creek.

Base flows have been reduced by water diversions for irrigation. Overall peak flows are not believed to have been significantly altered by management except in Little Bridge Creek which is considered functioning at risk due to valley bottom roads adjacent to most streams in the sub-watershed.

B5. At-Risk Fish Populations – Score 9

Spring chinook salmon, steelhead, and bull trout are found in most of the mainstem Twisp and some tributaries. The Twisp River is very important for all three species and high quality habitat makes the watershed potential refugia in the Methow Sub-Basin. The Twisp spring chinook are considered to be genetically different from the mainstem Methow and Chewuch spring chinook populations. Steelhead are believed to spawn and rear in the Twisp but to what extent is unknown. The greatest known concentration of bull trout spawning in the Methow Sub-Basin is found in the Twisp Watershed. The Buttermilk Creek, Upper Twisp River, and North Creek Sub-Watersheds are considered significant for bull trout. The Lower and Middle Twisp Sub-

Watersheds are considered significant for spring chinook.

Existing habitat conditions were obtained from the most recent environmental baseline established in the "Final Watershed Aquatic Species Biological Assessment for New and Ongoing Projects," April 4, 2001.

C. Wildlife

The Twisp River Watershed is a moderately-sized (156,972 acres) watershed on the west side of the sub-basin. This watershed provides quality wildlife habitat. Human use is high and motorized activity tends to be concentrated along a parallel road system that bisects the watershed. There are several opportunities for improvement within this watershed, especially with regard to deer fawning.

C1. Wide-Ranging Carnivores

The Twisp River Watershed is in good condition with regard to core habitat. The open road density is low at 0.73 mi/mi^2. Only 72.1% of the watershed is core habitat, for a total of 113,216 acres. Portions of nine Lynx Analysis Units (LAUs) are located within the Twisp River Watershed (with areas >0.1 sq. mile). The following table describes the road density of those portions within the Twisp River Watershed. For descriptions of each LAU, see Appendix C.

Table 7. Road density of Lynx Analysis Units within the Twisp River Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Crescent Mtn.	2.6	35.4	0.1
Frisco Mtn.	0	0.1	0
Indianhead Basin	0	0.3	0
Methow Gold Ck.	0	0.2	0
Milton Mtn.	5.8	19.4	0.3
Purple Mtn.	0	0.3	0
Snowshoe Ridge	2.9	40.3	0.1
Spirit Mtn.	19.2	36.1	0.5
Twisp	36.2	49.0	0.7

Mean Road Density = 0.2 mi/mi^2

C2. Late-Successional Associated Wildlife Species

Small areas of the Sawtooth and Upper Methow River LSRs are located within the Twisp River Watershed, covering a total of 20 acres (0.02%). Almost all of the Twisp River LSR is located within the Twisp River Watershed. This large portion of the Twisp River LSR occupies 36,324 acres (23.1%). The road density within the Twisp River LSR is low at 0.8 mi/mi^2, resulting in a high habitat effectiveness with regard to road density.

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 17,188 acres (11.0%) of the Twisp River Watershed.

The open road density within the riparian reserves is moderate, at 1.2 mi/mi^2.

C4. Ungulates

The Twisp River Watershed is especially important to ungulates for fawning and summer range. Some low elevation areas near the mouth of the watershed are used as winter range.

C5. Unique Habitats

The Twisp River Watershed has an abundance of unique habitats. Cliff habitats occur along the Sawtooth Crest, with notable cliffs in the Buttermilk Butte and Oval Lake areas. The Twisp River Watershed analysis identified more than 13,000 acres of high elevation meadows and approximately 5,000 acres of talus and rock outcrops. High snag levels are present in the upper drainage, due to root rot, pine beetles and other mortality factors. An outbreak of Douglas-fir tussock moths will result in additional tree mortality and increasing snag levels in the future.

II. Analysis

Human Use

This section of the roads analysis identifies the levels of importance of the road system to the human use activities in the particular sub-basin or watershed; it also identifies the primary activities or combination of activities for which the road system is used. Social values vary greatly among users. Users with similar interests will have differing perceptions of what constitutes appropriate access. It is not possible to satisfy every individual or group of individuals, nor is it possible to identify what people will desire tomorrow or into the next decade. It is possible to observe trends and at least make some qualitative estimates of what the future needs may be, but will not attempt to make quantitative predications of future needs.

Because there is a great deal of overlap in social needs, it is important to keep in mind the scale of population of users being considered: is it small scale/local community, medium scale/multiple community, large scale/regional, or very large scale/national importance? This consideration will help the decision maker determine whether the management of a particular road segment will have a direct or indirect effect on the user.

The human use factors are grouped into broad categories relating to the amount of flexibility the decision maker has, whether the value is expected to be of local, regional, or national scale, the current use pattern, and desired future condition. The rating criteria are described in detail in Appendix A. In this analysis, segments with scores of 41 and above were given a high priority, or a high need to maintain some type of passenger car access. Roads with scores of 34 to 41 received a moderate priority or need, and those with scores of 33 and below a low priority. All road segments in the analysis received a high score for the ROS Class criteria and all but two segments received a high score for the Level of Use Criteria. For this reason, these criteria are not noted in the discussions for the individual road segment scores.

Aquatics

Based upon the Aquatic Analysis, road segments were placed into high, medium, or low priority for treatment. The priorities were determined based upon a simple frequency distribution of the aquatic score for the segments then verified by local knowledge (see Aquatic Impact/Risk Table in Appendix B). High priority segments scored 24 or higher. Medium priority segments scored between 17 and 22 while low priority segments scored under 17.

Generally, high priority roads are accelerating fine sediment delivery into streams with at-risk fish and or have constricted stream channels. Roads that were providing dispersed recreation access to riparian habitat were also often ranked high, especially where riparian and aquatic habitat impact has been observed (erosion, streambank damage, loss of large wood, for example). The following is a brief description of the high priority roads by watershed. Because no arterial or collector roads are in the Early Winters Watershed, no analysis was completed for the watershed.

Wildlife

This section summarizes the results for the major arterial and collector roads in the Methow Sub-Basin. The wildlife categories that were addressed included: wide ranging carnivores, late successional species, riparian dependent species, ungulates and unique habitats. Road segment priority ratings were determined by summing the category scores derived from the Wildlife Roads Analysis Procedure (see Appendix C).

High-rated road segments generally scored moderate to high in four to five categories. Roads within riparian areas are one of the biggest problems in the Methow Sub-Basin. Therefore, a substantial number of road segments offer great potential for restoring riparian areas and connectivity. Second, numerous opportunities to improve core are available. However, if the opportunity to increase the overall amount of core exists in marginal habitat, the potential rating was decreased. Opportunities to improve habitat effectiveness for ungulates and restore unique habitats contributed, as well. High priority segments scored greater than 20 points.

Moderate-rated road segments usually have one element of strong potential, generally restoration of riparian and unique habitats, or improvement of core habitat, and moderate to low potential in the remaining categories. Moderate priority segments scored 10 to 20 points.

Low priority segments were often characterized by either excellent habitat conditions or very limited restoration opportunities. Limiting factors include bituminous road surfacing and high human use. These road segments scored less than 10 points. Very few roads are in this category because of the high road densities and riparian issues.

Restoration of riparian habitat and connectivity tends to drive the ratings within the Methow Sub-Basin. Because the roads cover a large area and a variety of habitats, the overall rating consists of various combinations of categories. The following discussion gives a general description of those roads with the greatest potential for improvement within each watershed. For more detailed information, see Appendix C.

Chewuch Watershed

A. Human Use

A human use rating of high was applied to the following roads in the Chewuch Watershed:

Middle Salmon Boulder road (3700000)
Eastside Chewuch road (5010000)
Chewuch road (5100000)
Eightmile road (5130000)
Cub Goat road (5200000)

The Meadows-Toats road (3900000) received a moderate rating.

The following roads received a low rating:

Falls Creek road (5140000)

Chewuch road (5160000), Boesel road (5215000)
Ortell road (5220000)

All of these roads are used for range management. They are also needed for silvicultural treatments of the timber stands outside the range of historic variation. Noxious weeds are present along all these roads. People use these roads to reach developed and dispersed recreation sites, and to access firewood and Christmas trees. The consensus of the public comments was to maintain access on all these roads.

Most of these roads should remain at the existing maintenance level. The exceptions are Boesel Canyon road (5215000) and Ortell road (5220000), both of which could be dropped to a maintenance level 3.

For resource protection, improvements are needed on spots of the following roads, but their maintenance levels should remain the same:

Boulder road (3700000)
Meadows-Toats road (3900000)
Eastside Chewuch road (5010000)
Eightmile road (5130000)
Cub Goat road (5200000)

B. Aquatics

Middle Salmon Boulder - 3700000 road. Erosion from upslope, cut and fill slopes is delivered directly to Boulder Creek and the Lower Chewuch River. Drainage improvements should be considered.

Meadows-Toats - 3900000 road. Needs improved drainage to handle the extensive capture of subsurface water and the erosive soil.

Eastside Chewuch - 5010000 road. Road is on the east side of the Chewuch River. Potentially needs reconstruction because the road crosses alluvial fans, channel is cutting into the toe of the fill in locations, drainage improvement needed. Major reconstruction or maintenance and possible control of the access needs to be assessed.

West side Chewuch - 5100000 road. This paved road is on the west side of the Chewuch River. Because spurs off this road are routing sediment onto the segment, drainage improvement is needed on the spurs and possibly the segment. Need to continue implementation of Respect the River due to heavy dispersed recreation access to the floodplain and off-road access to spawning fish.

Eightmile - 5130000 road. Reconstruction of the unpaved portion of the Eightmile road may be needed. The road has elevated the risk of debris slides, the upper 1/2 to 1 mile of the road is near Eightmile Creek and the fill slope directly delivers sediment to the stream. Another concern is the road allows cattle to access the stream. The cattle access should be addressed in the annual operating plan.

Eightmile - 5130000 road, paved segment. The paved segment of this road confines the stream channel. A confined stream channel limits wood recruitment. The proximity of the road to the stream increases sediment delivery from fill-slope erosion, provides dispersed recreation access to the stream and allows a means by which cattle can access the stream.

Chewuch - 5160000 road. This segment is the west side of the Chewuch road from Camp 4 up. The main problem is a need to continue Respect the River efforts to avoid/mitigate dispersed recreation impacts. The road is located on a terrace in an area of mass wasting directly above a spring chinook salmon spawning area.

Cub Goat Creek - 5200000 road. This segment of the Cub Creek Road is in an area of high road density. Road needs improved drainage or reconstruction to reduce sediment delivery.

Cub Goat Creek - 5200000 road. The second segment of the Cub Creek road needs reconstruction. Undersized culverts contribute to road washouts; dispersed access near the Vanderpool dispersed site may need some form of control due to the site's proximity to bull trout spawning. Channel straightening due to the road has disconnected the stream from cold water springs; the road facilitates livestock access to the stream.

Ortell - 5220000 road. Needs improved drainage to reduce sediment and improve fish passage.

C. Wildlife

Upper Chewuch River Watershed

Because a majority of the Upper Chewuch River Watershed (UCRW) is wilderness, the watershed has a very low road density of 0.11 mi/mi^2. Parts of road segments, Chewuch road (5160), and Meadows-Toats road (3900), fall within the watershed boundaries. These roads are discussed in the Lower Chewuch River Watershed section.

Lower Chewuch River Watershed

The road density in the Lower Chewuch River Watershed (LCRW) is moderate at 1.64 mi/mi^2. Of the 13 road segments in the LCRW, eight (62%) received a high rating for potential improvement, four (31%) received a moderate rating for potential improvement, and one (8%) received a low rating.

Middle Salmon Boulder Road 3700000. Modifications to this road have high potential for habitat improvement in four categories. This road runs along Boulder Creek through the southern portion of the watershed. The road is often very close to the creek, creating numerous opportunities for improving riparian habitat and connectivity. It also runs along unique habitats, such as boulders, cliffs, and aspen stands. The lower section of the road is paved, but the upper, graveled section runs through good lynx habitat and bisects core habitat, where wolf and grizzly bear sightings have been reported. It is also an important deer winter range area.

Meadow-Toats Road 3900000. This road extends from Road 3700000. It, too, bisects core

habitat and is in an area important to all wide-ranging carnivores covered in this analysis. The upper end of the road crosses numerous wetlands, presenting a restoration opportunity.

Eastside Chewuch Road 5010000. Modifying this road provides a good opportunity for restoring riparian habitat and improving ungulate habitat effectiveness. However, Road 5010 parallels the Chewuch River (on the east side) and a road system on the other (west) side of the river; therefore, improvements may be limited by the parallel road system.

Chewuch Road 5100000. Road 5100000 parallels the Chewuch River on the west side. The upper end of this road runs out toward Thirtymile Campground and wilderness lands. The upper end presents better opportunities for improving core habitat. A small section of the road runs through good pine and songbird habitat in the Upper Methow LSR. Due to its proximity to the Chewuch River, riparian restoration potential is high.

Eightmile Road 5130000. The lower section of this road is paved and experiences very high human use. The road services numerous tributaries and is surrounded by other roads. Therefore, modification of the road provides high potential for creating core habitat. Cows have heavily modified the habitat. This road also provides potential for improving ungulate fawning areas and restoration of unique habitats. The upper section of this road has even greater potential to improve core habitat as it runs through good lynx habitat and out to wilderness lands. There are also opportunities to restore riparian habitat and possibly improve LSR habitat.

Chewuch Road 5160000. Modifying this road provides high potential to restore riparian habitat because it runs along the Chewuch River. Deer and hunters heavily use this area. Potential to improve core habitat increases toward the end of the road.

In summary, the ratings within the Lower Chewuch River Watershed tend to be driven by restoration of riparian areas. Ratings are also influenced by core habitat availability for wide-ranging carnivores and habitat effectiveness for ungulates. Practical application and effective improvements depend on reducing overall road densities, perhaps by obliterating redundant roads which parallel one another. This watershed possesses a high potential for improvement and therefore a high priority for analysis at the watershed scale.

Upper Mainstem Methow Watershed

A. Human Use

A high human use rating was reached for Blackpine Basin road (5225000), and a medium rating for Harts Pass road (5400000).

Blackpine Basin road (5225000) is used for range management and for silvicultural treatments in the Blackpine Basin. Harts Pass road (5400000) road accesses inholdings and mining claims. It is also a popular hiking and camping areas in and around Harts Pass.

No changes in maintenance levels were recommended for either road, but both need repairs for resource protection.

B. Aquatics

Harts Pass – 5400000 road. This is the main Methow Valley Road from Lost River to Harts pass. There is a need to manage dispersed recreation access to reduce impact to riparian habitat and reduce driving in the stream channel.

C. Wildlife

The road density in the Upper Methow River Watershed (UMRW) is low at 0.38 mi/mi^2. Both (100%) road segments in the UCRW received a high rating for potential improvement.

Blackpine Basin Road 5225000. The lower section of this road is located within the Middle Methow River Watershed. Modification of this section of the road could increase core habitat in areas with moderate to high habitat values. This section of the road eventually connects to wilderness and is located in an area of lynx habitat, and wolf and grizzly bear sightings. Although it does run through the Upper Methow LSR, the habitat has been highly modified through grazing and logging. Potential to enhance ungulate habitat effectiveness, primarily fawning, exists as well.

Harts Pass Road 5400000. Human use of this road is extremely high because it is the sole access road to Harts Pass. Modifying the road presents very high potential to improve core habitat for all wide-ranging carnivores, as it currently bisects core habitat. Abundant and diverse unique habitats are located along the road as well. The lower end of the road is important to deer for fawning.

Although there are several opportunities for habitat improvement in the Upper Methow River Watershed, at the sub-basin level of analysis, because of very high human use, practical application may be limited.

Middle Methow Watershed

A. Human Use

The following roads received a high human use rating:

South Hunter Mt. road (4100000)
Benson Creek road (4150000)
South Fork Salmon road (4200000)
Coal Rader road (4410000)
Virginian Ridge road (5005000)
Cub Goat Creek road (5200000)
Blackpine Basin road (5225000)

No roads were rated as moderate.

South Beaver road (4225000), Beaver Summit road (4230000), Starvation Mountain road (4235000), and Boesel Canyon road (5215000) received a low rating.

All the roads are used in range management, and access timber stands that will likely need silvicultural treatments in the future. There are noxious weeds growing on all the roads. The roads are popular with dispersed recreationists.

No changes were recommended for the 4100000, 4200000, 5005000, and 5225000 roads. The 4150000, 4410000, and 5200000 roads need spot repairs for resource protection, but the maintenance level should not change. The maintenance level could be reduced on the 4230000 and 4235000 roads after spot repairs are completed. These repairs would benefit resource protection by reducing erosion. The maintenance level could also be dropped on road 5215000, and no repairs are needed.

B. Aquatics

South Beaver – 4225000 road. Road is located on very erosive soil. Extensive cut and fill slope erosion directly into streams. Drainage needs to be improved because culverts are inadequate. Road provides livestock access which exacerbates erosion problems. The road is providing dispersed recreation access to the riparian area, which is a growing concern. Consider significant relocation or obliteration.

Starvation Mountain – 4235000 road. Fine sediment delivery to streams is a concern. Road is located on high erosion hazard soils with high potential for sediment delivery. Cut slope erosion drains into Lightning Creek, a tributary to Beaver Creek, historic bull trout habitat, and the species may persist in the area. The road is also located at the toe of a large wetland. Improved drainage is needed.

C. Wildlife

The road density in the Middle Methow River Watershed (MMRW) is the highest within the Methow Sub-Basin at 1.78 mi/mi^2. Of the 13 road segments in the analysis, two (15%) received a high rating for potential improvement, nine (70%) received a moderate rating, and two (15%) road segments received a low rating.

South Beaver Road 4225000. The opportunities for improvement along this road exist primarily in riparian habitat restoration, protection/restoration of aspen stands and wetlands, and enhancement of habitat effectiveness for ungulates. These opportunities could be realized through road modification. This area is important deer winter range, but is also the site of heavy snowmobile use.

Blackpine Basin Road 5225000. Modification of this road could significantly increase core habitat in areas with moderate to high habitat values. This road connects to wilderness and is located in an area of lynx habitat, and wolf and grizzly bear sightings. Although it does run through the Upper Methow LSR, the habitat has been highly modified through grazing and logging. Potential to enhance ungulate habitat effectiveness, primarily fawning, exists, as well.

The Middle Methow River Watershed is a site of very high human use. This will likely limit opportunities for improvement.

Lower Methow Watershed

A. Human Use

All the roads rated high for human use in this watershed:

Black Canyon 4010000
South Hunter Mt. 4100000
Benson Creek 4150000
Buttermilk Libby 4300000
South Fork Gold Creek 4330000
North Fork Gold Creek 4340000

The roads listed above are all used for range management and silviculture treatments. Noxious weeds grow along each road.

No changes or repairs are needed on roads 4010000 and 410000. The 4150000, 430000, 4330000, and 4340000 roads have appropriate maintenance levels, but need spot repairs for resource protection.

B. Aquatics

Buttermilk Libby – 430000 road. May need significant reconstruction or relocation. There is potential mass failure from the road. A failure upstream of Bend Canyon Creek delivers sediment to nearby steelhead spawning area.

North Fork Gold Creek – 4340000 road. Road is located adjacent to historic spring chinook habitat in the stream. This is the paved section of the road. The road has straightened Gold Creek and the road is being undercut. Major reconstruction or relocation is suggested. The lower 3/4 miles are located on private land.

C. Wildlife

The road density in the Lower Methow River Watershed is moderate at 1.54 mi/mi^2. Of the six road segments in this watershed, one (17%) received a high rating for potential improvement and five (83%) received a moderate rating for potential improvement.

Buttermilk Libby Road 4300000. Modification to this road provides high potential to restore riparian habitat along Mission Creek. It also provides high potential to improve core habitat, because road modification could affect numerous tributaries. The road runs through lynx habitat and wolf sighting areas. This road also runs through a substantial amount of aspen, wetlands, and beaver ponds.

In summary, the ratings within the Lower Methow River Watershed tend to be driven by potential for riparian and core habitat improvement. This watershed's habitat quality, moderate road density and human activity suggest a moderate priority for attention at the watershed analysis scale.

Twisp River Watershed

A. Human Use

The following roads received a high human use rating:

Buttermilk Libby road (4300000)
Twisp River road (4400000)
Coal Rader road (4410000)
Little Bridge Creek road (4415000)
Eagle Creek road (4420000)

Reynolds road (4435000) and Twisp River road (4440000) received a moderate rating, and West Twisp River road (4430000) road received a low rating.

The moderate and low roads are not used for range management, and do not access timber stands likely to be treated in the future. The roads with a high rating all receive heavy recreation use. Noxious weeds grow along all of them.

No changes or repairs were recommended for the 4300000, 4400000, 4410000, and 4420000 roads. The maintenance level could be reduced on the 4435000 road. The 4415000, 4430000, 4435000, and 4440000 roads need repairs for resource protection, but their maintenance levels are appropriate.

B. Aquatics

Little Bridge Creek – 441500 road. Road accelerates sediment delivery due to road surface, cut and fill slope erosion. Culverts are undersized and dispersed recreation in the riparian reserve is affecting riparian habitat. Need reconstruction to reduce erosion.

West Twisp River – 4430000 road. All road crossings of fish bearing streams are considered to be passage barriers. Passage improvements needed.

Reynolds – 443500 road. Section of the road from the Horse Camp to Reynolds Creek is within a landtype with high risk of debris slides. Currently a driveable dip is constructed at the slide crossing. Off-road access to wetlands is adversely affecting wetlands. Road is rated high for floodplain riparian habitat element. The Twisp River is an important spring chinook and bull trout spawning/rearing stream. Reducing impact to riparian habitat and wetlands should be considered.

Twisp River – 4440000 road. This section of road runs from Mystery Camp to the end of the road. Access to the campground at the end of the road needs to be managed to reduce potential poaching of spawning bull trout. The road crosses an active landslide and the stream is undercutting the road. Drainage improvement is needed due to under-sized culverts and a flat section of road.

C. Wildlife

The road density in the Twisp River Watershed (TRW) is low at 0.73 mi/mi^2. Of the 10 road segments in the TRW, eight (80%) received a high rating for potential improvement and two (20%) received a moderate rating.

Buttermilk Libby Road 4300000. This road presents moderate to high potential for habitat improvement in four categories: improving core habitat, restoration of riparian areas and protection of Bull Trout, enhancement of deer fawning areas, and restoration of aspen stands, wetlands, and beaver ponds.

Twisp River Road 4400000. This road runs along the north side of the Twisp River, and a parallel road system on the south side of the river. The roads bisect core habitat, so both road systems would need to be addressed for effective changes. Modification of this road has great potential to enlarge core. This area would also benefit from alteration, because of heavy use by deer for fawning grounds and summer range. Twisp River Road 4400000 also runs along abundant and diverse unique habitats, such as rattlesnake dens, aspen stands, wetlands, and snags.

Eagle Creek Road 4420000. This short road segment runs out to War Creek. Great potential exists to improve security habitat for spotted owls located in the area.

West Twisp River Road 4430000, Reynolds Road 4435000 (lower and upper sections). These road segments run into each other, paralleling the south side of the Twisp River and the northern road system. Alteration of these roads has potential to improve core habitat, increase security habitat for late successional species such as owls and goshawk, and enhance habitat effectiveness for significant deer fawning areas.

Twisp River Road 4440000. This road in the Twisp River drainage presents an opportunity to greatly improve core and security habitat. The road bisects good core habitat for wide-ranging carnivores and the Twisp River LSR. Altering this road could also greatly improve habitat for deer with regard to fawning. Restoration of riparian and numerous unique habitats is also feasible.

In summary, the ratings within the Twisp River Watershed tend to be driven by enhancement of habitat effectiveness for ungulates, primarily through protection of heavily-used fawning areas, and improvement of core and riparian habitats. Practical application and effective improvements depend on solving the parallel road systems problem. This watershed provides quality habitat. The low road density and high human use of the area suggest a moderate to high priority level for watershed level assessment.

III. Recommendations

The range of recommended treatments or strategies fit into five general categories, ranging from major improvements to decommissioning. The five categories are:

1. Major repair or improvement
2. Minor repair or improvement
3. Leave as is, lower maintenance requirements
4. Stabilize then eliminate maintenance requirements
5. Decommission

These categories are described in greater detail in Appendix D.

Major repairs can include but are not limited to: relocation, replacing a major culvert, or seasonal closure. Minor repairs can include but are not limited to minor surfacing or grading work, drainage improvements such as adding cross drains or drain dips, or seasonal closures.

"Leave as is" means the current maintenance standards would be maintained with no change. The "lower maintenance requirements" strategy would reduce the current maintenance standard to the next lower standard. For example, a maintenance level 3 road, maintained for passenger cars would be reduced to a road with a maintenance level 2, which is maintained for high clearance vehicles.

The "stabilize then eliminate maintenance" strategy would involve stabilizing the road, for example by out sloping, installing water bars, removing culverts where possible, then inspecting the road periodically to monitor for any damage. Users will notice little change in the short term on the roads with recommended strategies of "lower the maintenance requirements" or "eliminating maintenance after the road is stabilized." The road will be allowed to reach the new standard over time.

The "decommissioning" strategy can involve a range of treatments from ripping and seeding the surface to full obliteration.

Some type of change in management strategy was recommended for 28 of the 44 road segments that were analyzed. The recommended changes in strategy ranged from improvements to lowering maintenance levels. Of the 28 recommended changes, 10 are to make a major improvement of some type to mitigate resource impact while maintaining passenger car access. This accounts for approximately 80 miles; however, in many cases the repair or treatment is at a specific location and is not the full length of the road.

Minor improvements, such as installing additional cross drains, or seasonal closures are the recommended strategy on 11 segments for approximately 68 miles. Seven segments, on approximately 50 miles of roads, received the recommended strategy to preserve the access, but reduce the level of maintenance applied to the road. There were no segments identified with the recommendation of decommissioning or putting in a "self-maintaining" state. Only the roads with a recommended change in treatment or strategy are listed in the following tables. Appendix

D includes a complete list of all roads analyzed and recommended strategies.

If all the recommended strategies were implemented fully, the cost to maintain these roads to full standards would decrease about $147,600 per year for the Methow Valley Ranger District, from $983,000 to $835,400 per year. However, a substantial amount would be needed to make all the repairs, and improvements, recommended to fully implement all the strategies. The specific projects needed to implement these strategies are not known in enough detail at this time to develop cost estimates. On roads which have Cost Share Agreements, the cost share partner must be consulted and agree to any changes in road management. It is important to note that these dollars reflect the needs to maintain only the roads analyzed to the standards defined in the Forest Service Manual. This is not the amount that is currently being spent. The districts received a total of approximately $210,000, which was used to maintain all the roads on the system, not just the major arterials and collectors. This discrepancy of funds needed versus funds received highlights the need to determine the minimum affordable road system.

Minimum Affordable Road System

The Forest Service defines the minimum affordable road system as the miles of road by the maintenance level that can be maintained to full standard with the anticipated maintenance funding. Based on forest average maintenance costs, it would require approximately $2,703,000 annually to maintain all of the system roads in the Methow Sub-Basin. These values do not include the costs for the identified deferred maintenance, the maintenance needed to bring roads back up the standard described in the Forest Service Manual, or the funds needed to improve fish passage by repairing or replacing barrier culverts. In Fiscal Year 2000 approximately $210,000 (15% of the estimated annual need) was expended for maintenance on the roads in the Wenatchee Sub-Basin. However, rather than maintaining a small percentage of the roads to full standard, the work was distributed over a greater mileage to address high priority needs.

Budget projections indicate that funding for road maintenance will continue at current levels for the foreseeable future. Consequently, $210,000 was selected as the planned amount for the minimum affordable road system for the sub-basin. Based on that funding level and the average costs per mile by maintenance level, the following table displays the extremes in the range of potential road management scenarios. Option A shows the number of miles of road that can be maintained to standard starting with the level 2 (high clearance vehicle) roads first. The number in parenthesis is the percent of the total system roads in the sub-basin that would be maintained to standard. Option B shows the number of miles of road that can be maintained to standard starting with the level 3-5 (passenger vehicle) roads first. From a practical standpoint, the minimum affordable system would likely be a combination of arterials and collectors maintained for passenger cars, and local roads maintained for high clearance vehicles.

Table 8. Minimum affordable road system options

Maint. Level	Option A		Option B	
	mi.	(% of total)	mi.	(% of total)
ML 2 (high cl.)	208	(15)	0	(0)
ML 3-5 (pass.)	0	(0)	55	(4)

This analysis demonstrates there are many more miles of roads than can be fully maintained with the expected funding. However, a rapid reduction in accessible road mileage is not acceptable to a large segment of forest users, would not meet agency management access needs, and would incur significant expense to properly implement.

As stated above, this analysis did not recommend any road segments be decommissioned. Future studies that will analyze the local roads, (those maintained for high clearance vehicles) have the potential to recommend decommissioning some roads in an effort to adjust the size of the road system.

Chewuch Watershed

Four roads received a recommendation strategy of "major repair or improvement." Four roads received a recommendation strategy of "minor repair, improvement or seasonal restrictions," and one road received a recommendation strategy of "lower maintenance standard." All other roads analyzed in the drainage received "leave as is" recommendations. Table 9 summarizes the recommendations.

The recommendation for the upper 7.5 miles of Middle Salmon Boulder road (3700000) is to stabilize the eroding slopes. Surfacing improvements and additional cross drains are recommended for the first 11 mile section of Middle Salmon Boulder road. Additional water control measures in the wetlands and ditch improvements along Meadows-Toats road (3900000) are recommended. Recommendations for the Eastside Chewuch (5010000) include improving the drainage along the road and improving the management of the dispersed recreation use in the Riparian Reserves. In addition, consider obliterating the summer home road to Twentymile junction.

Major and minor repairs are also recommended for Eightmile (5130000) road; improve the live stream crossings designated livestock for the length of the road, consider spot surfacing improvements as needed along the first 11-mile segment and stabilizing cut and fill slopes as needed on the upper five mile section. The recommendation for Cub Goat Creek (5200000) is to upgrade culverts along the road to accommodate fish passage, and provide additional drainage features. The recommendation for both Ortell (5220000) and Boesel Canyon road (5215000) is to lower the maintenance standard from a level 3 (accessible to passenger cars) to a level 2 (maintained for high clearance vehicles). This should be done after drainage improvements are made, such as adding drivable waterbars or cross drains.

Table 9. Chewuch Watershed recommendations

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom mgmt	Final recom mgmt
Middle Salmon Boulder	3700000	7.45	H	H	H	Major repair	
Meadows-Toats	3900000	6.12	H	H	M	Major repair	
East Side Chewuch	5010000	10.7	H	H	H	Major repair	

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom mgmt	Final recom mgmt
Eightmile	5130000	11.14	H	H	H	Major repair	
Middle Salmon Boulder	3700000	11.1	M	H	H	Minor repair	
Eightmile	5130000	5.2	H	H	H	Minor repair	
Cub Goat Creek	5200000	7.4	H	L	H	Minor repair	
Boesel Canyon	5215000	3.9	L	M	L	Lower maint.	

Upper Mainstem Methow Watershed

One road received a recommendation of "major repair or improvement" and one road received a recommended strategy of "minor repair, improvement or seasonal restrictions," and then "lower the maintenance standard." All other roads analyzed in the drainage received "leave as is" recommendations. Table 10 summarizes the recommendations

The recommendation for Harts Pass road (5400000) is to consider developing a funding strategy for safety improvements that are needed and restricting off road access. The recommendation for the upper 4.6 miles of Blackpine Basin is to consider a spring closure for the portion of the road past the lookout and to reduce the maintenance standard from a level 3 (accessible to passenger cars) to a level 2 (maintained for high clearance vehicles).

Table 10. Upper Mainstem Methow Watershed recommendations

Road name	FS rd. #	Seg. length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Harts Pass	5400000	12	H	H	M	Major repair	
Blackpine Basin	5225000	4.6	L	H	H	Minor repair/ Lower maint.	

Middle Methow Watershed

One road received a recommendation strategy of "major repair or improvement." Two roads received a recommendation strategy of "minor repair, improvement or seasonal restrictions," and two roads received a recommendation strategy of "lower maintenance standard." And two roads received a combined recommendation of "minor repair, improvement or seasonal restrictions," and "lower the maintenance standard." All other roads analyzed in the drainage received "leave as is" recommendations. Table 11 summarizes the recommendations.

The recommendation for Cub Goat Creek road (5200000) is to upgrade culverts as needed to accommodate fish passage. Consider drainage improvements on Benson Creek road (4150000), Beaver Summit road (4230000), Starvation Mountain road (4235000), and Coal Rader road (4410000). Consider reducing the maintenance standard from a level 3 (accessible to passenger cars) to a level 2 (maintained for high clearance vehicles) on Beaver Summit, Starvation

Mountain, South Beaver, and Boesel Canyon (5215000). Two additional recommendations for the South Beaver road are to consider moving the cattleguard and fence to restrict cattle use and to decommission the last 1.5 miles due to sediment concerns.

Table 11. Middle Methow Watershed recommendations

Road name	FS rd. #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Cub Goat Creek	5200000	10.7	H	M	H	Major repair	
Benson Creek	4150000	6	M	M	M	Minor repair	
Beaver Summit	4230000	13.7	M	M	L	Minor repair/ Lower maint.	
Starvation Mountain	4235000	11.5	H	L	L	Minor repair/ Lower maint.	
Coal Rader	4410000	4	M	M	H	Minor repair	
South Beaver	4225000	6.3	H	H	L	Lower maint	
Boesel Canyon	5215000	3.2	M	M	L	Lower maint.	

Lower Methow Watershed

One road received a recommendation strategy of "major repair or improvement," and four roads received a recommendation strategy of "minor repair, improvement or seasonal restrictions." All other roads analyzed in the drainage received "leave as is" recommendations. Table 12 summarizes of the recommendations.

A relocation or reconstruction of the last 1/4 mile of the lower paved section is recommended for North Fork Gold Creek road (4340000) due to the stream undercutting the roadway. There is concern about the dispersed recreation use along North Fork Gold Creek road and a need to improve the drainage of the road. Additional drainage structures and fill slope repairs are recommended for Benson Creek road (4150000). The minor repair recommended for Buttermilk Libby road (4300000) is to stabilize the roads at the Ben Canyon area. On the South Fork Gold Creek, two culverts need to be upgraded for fish passage.

Table 12. Lower Methow Watershed recommendations

Road name	FS rd. #	Seg. length (mi)	Aquatic rating	Wildlife rating	Human use fating	Draft recom. mgmt.	Final recom. mgmt.
North Fork Gold Creek	4340000	4	H	M	H	Major repair	
Benson Creek	4150000	2.6	M	M	H	Minor repair	
Buttermilk Libby	4300000	8.8	H	H	H	Minor repair	
South Fork Gold Creek	4330000	5.3	M	M	H	Minor repair	
North Fork Gold Creek	4340000	8.7	M	M	H	Minor repair	

Twisp River Watershed

Three roads received a recommendation strategy of "major repair or improvement." One road received a combined recommendation strategy of "minor repair, improvement or seasonal restrictions" and "lower maintenance standard." All other roads analyzed in the drainage received "leave as is" recommendations. Table 13 summarizes the recommendations.

Erosion control features along Little Bridge Creek road (4415000) should be considered for improvement. There are concerns about the dispersed recreation and cattle use along the road. Consider upgrading the culverts that are barriers to fish passage. The recommendations for West Twisp River road (4430000) are to consider a spring closure and to replace the barriers. On Twisp River road (4440000) consider a relocation to reduce the impacts of crossing an active landslide. The recommendation for the 0.2 miles of Reynolds road is to reduce the maintenance standard from a level 4 (some comfort for passenger car use) to a level 3 (accessible to a passenger car). The concern about the remainder of the road is the off-road access this road provides.

Table 13.Twisp River Watershed recommendations

Road name	FS rd. #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Little Bridge Creek	4415000	6.8	H	M	H	Major repair	
West Twisp River	4430000	4.3	H	H	L	Major repair	
Twisp River	4440000	6.5	H	H	M	Major repair	
Reynolds	4435000	4.05	H	H	M	Minor repair	
Reynolds	4435000	0.15	M	H	M	Lower maint.	

Watershed Analysis Priority

During the analysis process the team reviewed the condition and uses of the watersheds as a whole to determine a priority recommendation for the completion of the watershed scale analyses. The team looked at the existing conditions and impact within the watershed, types of use, anticipated future projects (such as dry site management or fuels planning), and the ability or opportunity to make changes. Table 14 shows the priorities.

Table 14.

Watershed	Human use rank	Wildlife rank	Aquatic rank	Composite rating
Lower Chewuch	H	H - 1	H	H
Lower Methow	H	M - 4	M	M
Middle Methow	M	H - 2	M	M
Upper Methow	L	M - 5	H	M
Twisp	L	H - 3	H	H

The Chewuch and Twisp watersheds are high priority for further roads analysis for aquatic resources. These watersheds provide important habitat for steelhead spring chinook salmon and bull trout populations protected under the Endangered Species Act.

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Appendices

Appendix A: Human Use
Appendix B: Aquatic
Appendix C: Wildlife
Appendix D: Management Actions
Appendix E: Public Input Summary
Appendix F: Definitions

Appendix A: Human Use

Human Use

Rating Criteria

The human use portion of the roads analysis identifies the level of importance of the road system on the human use activities in the particular sub-basin or watershed and to further identify primary activity or combination of activities the road system is used for. Social values vary greatly among users. Further, users with similar interests will have greatly differing perceptions of what constitutes appropriate access.

It is not possible to satisfy every individual or group of individuals, nor is it possible to identify what people will desire tomorrow or into the next decade. It is possible to observe trends and at least make some qualitative estimates of what the future needs may be. However, we generally lack sufficient data to make accurate quantitative predictions. This exercise attempted to show the major categories of human use that exist today on a broad scale, but did not attempt to make quantitative predictions of future needs.

Because of the overlap in social needs, it is important to keep in mind the scale of population of users being considered; is it small scale/local community, medium scale/multiple community, large scale/regional, or very large scale/national importance? This consideration will help the decision maker determine whether the management of a particular road segment will have a direct or indirect effect on the user.

The human use factors are grouped into broad categories relating to the amount of flexibility the decision maker has, whether the value is expected to be of a local, regional or national scale, the current use pattern, and desired future condition.

In the questions addressed section an alphanumeric code corresponds to the section in the "Roads Analysis Handbook," Appendix 1. This code is linked to an ecological consideration, which has been formulated as a question. Each risk factor evaluated addresses one or more of these questions. The appendix should be consulted for more information on the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor.

Factor 1: Required by Law, Agreements and Permits

This factor includes access needs that are necessary to meet legal requirements such as the Alaska National Interest Conservation Act (ANILCA), treaty requirements, easements, Memorandums of Agreement (MOA's), or permits of various kinds. RS 2477 (Revised Statute 2477) roads are included in this group. This factor includes the legal requirements, agreements, and commitments to other parties. Agreements can sometimes be modified, but usually they are of a long-term nature and can have significant influence on how a road is managed.

Questions addressed

Legal basis (GT-1, 2, and 3)
Special Use Permits (SU-1)
Water Production (WP-1)

Rating

1. Identify roads and segments to which Public Laws such as ANILCA, RS 2477, or treaty requirements apply.
2. Identify roads or segments which have active permits, cost share agreements, easements or binding agreements.
3. Identify roads or segments that have special use permits.
4. Relative ranking, based on the above information, is:
   a. High (10): public law requires the road access be provided. These include roads that have Cost/Share agreements and long term easements in place.
   b. Medium (7): agreements or permits exist, but there are alternatives or options available to meet identified needs.
   c. Low (3): there are short-term commitments, which will expire or can be replaced with suitable alternatives.

Data sources

Special Uses Data System (SUDS)
Forest Land Use Report (FLUR)
INFRA
District files of Agreements and Easements

Factor 2: Resource Management

This factor addresses the importance of the road system for administration, management, or protection of forest resources. The forest manager has the flexibility to analyze options and select the one that provides the best balance of resource, social and economic needs. At a sub-basin scale, definitions or classifications would be identified by broad groupings such as the percent of a watershed, the percent of a dry site, or a FMAZ zone.

Questions addressed

Value of road for implementation of desired future condition strategies, such as the "Dry Site Strategy" (PT-1)
Administrative Use needs (AU-1)
Value of road for Forest Service and cooperator to suppress wild land fires. Fire risk can be based on a combination of fire intensity mapping and knowledge of past fire occurrence. Fire intensity mapping is based on current vegetation, slope, aspect, elevation, and landform. This factor is considered highly important and is given a heavy numerical weighting. (PT-2,3)
Value of road for management of insect, disease, or noxious weed infestations
Does road system address public health and safety (GT-4)?

Does the Forest have the necessary easements and rights on the road?

Rating

1. Identify roads that are needed for access to protect forest resources, facilities, or property.
2. Identify roads that are important for implementation of management strategies.
3. Roads covered within this analysis provide primary access to wildfires occurring on the district, either directly to the fire or to connecting roads, trails, and/or drop-off points. Roads can also serve as primary control lines, fuel breaks, or fire fighter escape routes.
4. Vehicle travel on roads is a primary contributor to fugitive dust on the forest. Vehicle speed on any given road surface is the primary factor in determining the amount of dust or particulate matter introduced into the air shed. Of greatest concern is particulate matter less than 10 microns in diameter (PM10) and particulate matter less than 2.5 microns in diameter (PM2.5). Refer to individual Watershed Assessments for further discussion on the effects and importance of particulate matter.
5. Identify the roads that are important for research, monitoring, or inventory.
6. Relative ranking, based on the above information is:
    a. High (10): life or property is at risk or the history of severe resource damage occurring in this area. Road is necessary for protection of life and property. Access to private or leased property and/or structures and access must be retained. A road ranked high if it is considered important for protection of resources and there are few or no alternative ways to access the area. Road serves developed recreation site or administrative sites. Road is part of a designated or informal, but well recognized, auto tour.
    b. Medium high (7): access is necessary for resource protection for long term. Roads within the Low Fire Regime (naturally occurring as high frequency/low intensity) or roads that access pre-attack facilities. Road is needed for access to an active range allotment. Important for silvicultural treatments in dry and mesic sites. Road is important for treatment of existing noxious weed infestations in dry and mesic sites.
    c. Medium low (5): Roads within the Moderate Fire Regime with a high occurrence (also referred to as Dry Mesic) or roads that provide a midslope fire break.
    d. Low (3): access is needed for implementation of management strategies for the near future. Roads within the Moderate Fire Regime with a moderate or low occurrence. Needed for silvicultural treatment in wet sites. Noxious weeds present in wet sites and road access will be needed for treatment. Paved or rock surface; not a significant source of fugitive dust and particulate matter. On a short-term basis, this may also refer to roads treated with dust suppressant such as water, lignin, or oil-based products.
    e. Low (2): Gravel: fugitive dust and particulate matter will largely depend on vehicle speed and road condition.
    f. Very Low (1): Fires within the High Fires Regime, (naturally occurring as low frequency and high intensity. Native surface; significant source of fugitive dust and particulate matter.
    g. Not needed (0): road does not serve a range allotment. Road is not necessary for fire protection. No noxious weed infestations present.

Data sources

Analysis Files for Timber Sales and other projects
Past Harvest Layer - 5 year action plan
Fire Ignition Layer in GIS
Urban Interface mapping in GIS – natural vs. human caused fires
Infestation maps for insect and disease surveys
Past activity layer for weeds in GIS
Archeological probability maps (H/M/L)
Public Scoping

Factor 3: Public Access and Level of Use

The factor includes both active and passive use by the public for all forms of outdoor recreation where people are actually present on the Forest.

It also includes elements that do not necessarily involve active participation but just knowing these elements are in place or available has significant value. The forest manager will need to involve large numbers and diverse groups in any decisions associated with this factor.

The most common public needs are generally associated with some form of recreation or leisure activity. There would also be instances in which Forest-managed road systems would be used by persons involved with administrative or contractual activities. Their access needs could be associated with other factors such as fire protection or rehabilitation projects.

Since this factor by definition involves actual access and use of the road, it is most important on a local and regional scale. There would be a lesser degree of importance on a national scale for stakeholders who come from other regions or states and use the Forest.

The Recreation Opportunity Spectrum (ROS) classification is used in the Forest Plan to arrange the possible experience opportunities across a spectrum. ROS land delineations identify a variety of recreation experiences in six classes along a continuum from primitive to modern-urban. Each class is defined in terms of the degree to which it satisfies certain recreation needs based on area size, the extent to which the natural environment has been modified, the type of facilities developed and the degree of outdoor skills needed to enjoy the area. The seven ROS classes are: Primitive, semi-primitive non-motorized, semi-primitive motorized, roadbed natural, and roadbed modified, rural and urban.

Question addressed

Unique physical or biological characteristics (PV-1)
Unique cultural or spiritual value (PV-2)
People's perceived needs and values for the road (SI-1)
Value to local community social and economic health (SI-6)
Effect on people's sense of place (SI-10)
Unloaded recreation values (UR-1 through 5)
Roadbed recreation values (RR-1 through 5)
Access to developed sites

Access to undeveloped sites
Consistency with Recreation Opportunity Spectrum (ROS) classifications in the Forest Plan

Rating

1. Identify road or segments that serve developed sites, popular dispersed sites, or that are popular for recreation activities.
2. Identify the predominant ROS classification served by the road or segment.
3. Identify areas where the predominant recreation use is enhanced by lower road density. Leaning toward more primitive recreation activities.
4. Identify roads or segments that stakeholders have an expressed interest in keeping open for general Forest travel or exploring.
5. Identify roads or segments that stakeholders have expressed interest in reducing to a lower standard, converting to trail, or obliterating.
6. Relative rankings are based on the elements above:
   a. High (10): road is needed to access developed facilities activities toward the developed end of the ROS scale.
   b. Medium (6): activities are semi-primitive motorized or semi-primitive non-motorized portion of scale. Low standard roads are preferred and/or low density is preferred to enhance the recreation activity.
   c. Low (3): semi-primitive non-motorized or primitive ROS classification. Activities in this area are characterized by as more challenging and more secluded. The degree of skill needed is greater.

Data sources

Scoping for specific projects
Frontline contacts
Comment boxes and comment cards
Personal contacts
Travel cost surveys

Factor 4: Economics

This factor includes the relationship of the road system to local and regional economic values. The stakeholders in this group would be individuals and businesses that receive direct or indirect economic benefit from the forest. Though there are direct economic benefits from commodity production such as mining, grazing and wood products manufacturing, economic benefits are also derived by providing services through contracts or permits. Permitted uses could include such things as mushroom gathering, posts, poles, floral greenery, boughs, Christmas trees, and other miscellaneous forest products. The indirect benefits from people visiting the forest for business or pleasure are also important to communities at a local and regional scale. Economic values are market based involving supply and demand.

The Interior Columbia Basin Ecosystem Management Project scientists concluded "…that recreation use generates far more jobs than other uses of Forest Service and BLM administered

lands. Recreation provided by these public lands contributed about 15 percent of total jobs, area-wide." The geographic scale for this factor is primarily local and regional.

Questions addressed

Recreation and tourism (EC-3)
Commodity production (TM-3), (MM-1), (RM-1)

Rating

1. Identify roads or segments that access developed sites, fee sites, concession, or commercial permit operations, and that are necessary to directly support these services.
2. Identify roads or segments that are important for activities, which provide revenue to local communities and businesses.
3. Relative rankings are based on above:
   a. High (10): access is essential for commodity production or area business. Area served by road is in Matrix land allocation in Forest Plan and is important for timber production.
   b. Medium (6): tourism or local businesses benefit indirectly; other access points or forms of access could replace this road and businesses would not be severely affected. Road access is desirable to draw users into the communities. Area is allocated as Managed Late Success ional Reserve (MLSR) and will have some timber management activities. Includes areas that are in Matrix and are important for firewood gathering. Provides access to a range allotment.
   c. Low (3): economic dependency on access is either low or short term. Land allocation is Late Success ional Reserve (LSR) and will have limited timber treatment. Area is utilized for special forest products including products such as boughs, cones, bear grass, and transplants. Area is allocated MLSR and receives some use for firewood gathering.
   d. Very Low (1): Land is Administratively Withdrawn and will have only incidental timber treatment. Area is in LSR or is Administratively Withdrawn, and will occasionally produce some firewood as a byproduct of another activity.

Data sources

Sales Tax
Costs for Police, Ambulance and Fire services
SCORP report
Permits

Table A-1. Human Uses, Methow Sub-Basin

Road seg. #	FS rd. #	Seg. lgth.	Access required by law/agree.	Resource mgmt.	ROS class	Level of use	Econ.	Human use total	Human use rating
1	3700000	11.1	9	10	10	9	10	48	High
2	3700000	7.45	9	10	10	9	10	48	High
3	3900000	6.12	9	3	10	9	3	34	Mod
4	4010000	8.74	9	10	10	6	7	42	High
5	4100000	3.1	9	10	10	6	7	42	High
6	4100000	1.9	9	10	10	6	10	45	High
7	4100000	4.8	9	10	10	6	10	45	High
8	4100000	7.1	9	10	10	6	10	45	High
9	4150000	2.6	9	10	10	6	10	45	High
10	4150000	6	9	10	10	6	10	45	High
11	4200000	6.5	9	7	10	9	10	45	High
12	4225000	6.3	0	10	10	6	7	33	Low
13	4230000	13.7	0	3	10	6	7	26	Low
14	4235000	11.5	0	3	10	6	7	26	Low
15	4300000	8.8	9	10	10	9	10	48	High
16	4300000	3.9	9	10	10	9	10	48	High
17	4300000	3.4	9	10	10	9	10	48	High
18	4330000	5.3	9	10	10	6	7	42	HIgh
19	4340000	8.7	9	10	10	9	7	45	High
20	4340000	4.0	9	10	10	9	7	45	High
21	4400000	7.4	9	10	10	9	7	45	High
22	4410000	4.0	9	10	10	6	7	42	High
23	4410000	4.5	9	10	10	6	7	42	High
24	4415000	6.8	9	10	10	6	7	42	High
25	4415000	3.41	9	10	10	9	3	41	High
26	4430000	4.3	0	7	10	9	3	29	Low
27	4435000	4.05	9	7	10	9	3	38	Mod
28	4435000	0.15	9	7	10	9	3	38	Mod
29	4440000	6.5	9	3	10	9	3	34	Mod
30	5005000	4.1	9	10	10	9	3	41	High
31	5010000	10.7	9	10	10	6	7	42	High
32	5100000	10.6	9	10	10	9	10	48	High
33	5130000	11.14	9	10	10	9	7	45	High
34	5130000	5.2	9	10	10	9	10	48	High
35	5140000	11.5	0	7	10	6	7	30	Low
36	5160000	5.5	0	7	10	9	7	33	Low
37	5200000	7.4	9	10	10	6	10	45	High
38	5200000	10.7	9	10	10	6	7	42	High
39	5215000	3.9	0	10	10	6	7	33	Low
40	5215000	3.2	0	10	10	6	7	33	Low
41	5220000	9.8	0	7	10	6	7	30	Low
42	5225000	4.7	9	10	10	6	7	42	High

Road seg. #	FS rd. #	Seg. lgth.	Access required by law/agree.	Resource mgmt.	ROS class	Level of use	Econ.	Human use total	Human use rating
43	5225000	4.6	9	10	10	6	7	42	High
44	5400000	12	9	7	10	9	3	38	Mod

Appendix B: Aquatic

Aquatic Rating Criteria

The objective of the Aquatic Assessment is to characterize how the transportation system may be influencing watershed processes and aquatic habitat at the sub-basin and site scale. The assessment at the sub-basin and watershed scale is basically the same; the primary difference is the scale of road segment to be analyzed. The basic units of assessment at the sub-basin scale are the watersheds within the sub-basin and road segments of arterial and collector roads within the watersheds. The sub-basin scale analysis will help prioritize watersheds for further analysis based upon aquatic resources and potential restoration needs, identify issues within watersheds, establish context for the watershed or project scale analysis and identify potential management of the arterials and collectors. Analysis of local roads at the watershed or project level is basically the same but the segment is different. Ratings for the sub-basin scale analysis include overall watershed condition ratings and segment specific ratings. After the sub-basin scale assessment is completed it is anticipated that only information specific to the smaller segments will be needed as part of project analysis. The watershed condition ratings are based upon the watershed BAs with further information provided by completed watershed analysis and existing GIS layers. The watershed condition ratings establish a context for the road segment ratings. The segment ratings are based upon stream survey data, road logs, culvert surveys, and local knowledge.

Development of the Aquatic Impact, At-Risk Criteria

Aquatic criteria were developed to capture key processes associated with roads as they link to aquatic environments.

Criteria include:

1. Geologic Hazard
2. Road-Related Sediment
3. Floodplain off-channel habitat riparian reserve function
4. Flow Effects
5. At-risk fish populations and wetlands.
6. Wetlands and Wet Meadows

In the “questions addressed” section an alphanumeric code corresponds to the section in Appendix 1 of the “Roads Analysis Handbook.” This code is linked to an ecological consideration, which has been formulated as a question. Each evaluated risk factor addressed one or more of these questions. The appendix should be consulted for more information on the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor. The term “at-risk fish” in this document refers to fish listed as threatened or endangered under the Endangered Species Act.

Criterion 1: Geologic Hazard

This criterion was developed to incorporate the natural risk of mass wasting as an effect on roads or potential for roads to accelerate mass movement events. Three forms of mass movement were identified: debris slides (shallow rapid landslides, earth slumps (fairly deep land slides), and deep-seated landslides. On the Wenatchee and Okanogan Nation Forest debris slides are often associated with coarse textured sediment, earth slump medium textured sediment, and deep seated fine and very fine sediment.

The interpretation of mass wasting was taken from the Landtype Associations of North Central Washington's preliminary report. These interpretations were based upon observations of landslide features, Landtype Association site features, and literature references. The interpretations are based upon geomorphic mapping, bedrock weathering properties, geologic structural features, slope gradient, drainage characteristics and patterns, and regolith features.

Geologic Hazard was considered to be a highly important factor relating to aquatic conditions. The numerical weighting however was restricted, weighted heavily toward the high and very high hazards. Each road segment will receive a rating for Geologic Hazard.

Questions addressed

Mass wasting (AQ –3)

Rating

Low risk = 0
Moderate risk = 2
High risk = 6
Very high risk = 9

Criterion 2: Road-Related Fine Sediment

Surface erosion occurs on wildland roads due to erosion of the road surface, cut and fill slopes, and accelerated mass failures. Surface erosion of the road is sensitive to road design, road maintenance and geologic hazard. Road surface, design and maintenance of drainage structures can influence the amount of road surface erosion. Insufficient drainage structures, culverts, including ditch-relief culverts, can also be sources of sediment.

Roads crossing areas of high geologic hazard or with unstable fill slopes may contribute to accelerated mass wasting initiated by the failure of the fill slope. Culverts at stream crossings can be a sediment source if the culvert is under-sized and the hydraulic capacity is exceeded or the culvert inlet is plugged causing stream flow to overtop the road. Large amounts of sediment or mass wasting can also be generated if the plugged culvert fails at the crossing resulting in a debris flow. When the culvert is overrun it can result in the stream flowing down the road surface

eroding the surface and fill. Ditch relief culverts that erode fill material directly into streams are another sediment source.

Questions addressed

Generated Surface Erosion (AQ – 2)
Mass Wasting (AQ – 3)
Stream crossing influence local stream channels and water quality (AQ – 4)

Ratings

1. Fine Sediment-Watershed Condition

1 = Watershed is rated as Functioning Appropriately for fine sediment; transportation system consistent with the Aquatic Conservation Strategy (ACS).

3 = Watershed is rated as At Risk for fine sediment; road system is a contributor to fine sediment but is not believed to be a major contributor and road system is generally consistent with ACS.

6 = Watershed is rated as At Risk for fine sediment; roads are believed to be a major source of fine sediment and road system is inconsistent with ACS.

10 = Watershed is rated as Functioning at Unacceptable Risk for fine sediment; road system is believed to be a major contributor of fine sediment, and road system is inconsistent with the ACS.

2. Fine Sediment – Road Segment

1 = Road segments with a paved surface, crossings are bridged or sufficient to pass the 100 year flood and associated debris. Cut and fill slopes are vegetated and not eroding. Crossings are not impacting channel morphology downstream.

3 = Road segment is native surfaced, or graveled but no visible erosion, ditch relief culverts are not causing erosion of fill into streams, crossings are perpendicular to the stream and sufficient to pass the 100 year flood, or designed so that if they do fail only the prism at the crossing fails. Crossings are not impacting channel morphology downstream or causing downstream bank erosion. There is no evidence of accelerated mass wasting due to the road segment.

5 = Road segments not meeting above criteria to some degree but potential impacts to at-risk fish habitat appear to be minor due to amount of erosion, potential sediment delivery if a crossing failure or fill slope failure were to occur, changes to channel morphology due to a crossing is confined to the site or does not alter the channel type.

10 = Road segments with high potential impacts to at-risk fish habitat. Road surface and/or fill slopes exhibit either erosion into streams, visible ditch erosion, or cut slope erosion into ditches. Sediment directly enters fish-bearing stream from ditch, fill slopes begin to fail, and evidence of accelerated mass wasting due to the sediment becomes prevalent. Crossings with high potential for failure where failure of the prism will result in a large amount of sediment into at-risk fish habitat or the culvert is over-topped and it is highly likely the stream will travel down the road

and deliver sediment to at-risk fish habitat, crossings are altering stream channel type downstream and/or causing downstream bank erosion.

Criterion 3: Flood Plain Function, Off-Channel Habitat and Riparian Reserves

This criterion addresses how the road segment has altered the function of a stream's floodplain and/or off-channel habitat. Flood plains are important regulators of stream flow and water quality. They absorb over bank floodwaters, allowing water to soak through vegetation/organic mat, and into the ground. Here water can be stored and released more slowly into streams. In doing so, functioning floodplains can provide more water in late summer and reduce peak floods in winter and spring.

Roads can affect flood plains by:

- Limiting the frequency of over bank flows and concentrating greater volumes of water within stream banks.
- Interfering with the ability of the stream to migrate across its flood plain.
- Preventing slope runoff from recharging flood plain aquifers.
- Intercepting runoff and floodwaters, thereby eroding and degrading water quality.
- Indirectly degrading flood plain function by encouraging off-road motorized access from roads onto flood plains.

Indicators of direct and indirect flood plain or riparian reserve degradation include:

- Soil compaction
- Noxious weed introduction
- Evidence of soil erosion or mass wasting of road fill during peak runoff
- Water quality changes
- Artificial confinement of streams
- Stream bank erosion
- Interruption of hill slope delivery of water onto floodplain
- Loss of downed or standing woody debris that is both an energy dissipater and a habitat component

Similar impacts occur if roads are within or provide vehicle access to the portion of a riparian reserve that affects aquatic habitat. Effects include loss of bank vegetation with associated loss in cover and accelerated bank erosion, reduction in large wood from the channel or potential large wood due to wood cutting or hazard tree removal, soil compaction, and accelerated surface erosion.

Off-road access, provided by roads onto flood plains or riparian reserves is influenced by factors which include:

- Proximity of road to flood plain
- Slope of ground leading from road onto floodplain
- Desirability of flood plain determined by its width and demands for dispersed use.

With more alteration the likelihood increases that stream systems will not function properly and those road segments within the flood plain will be at higher risk of damage.

Off-channel habitats provide important rearing habitat and refuge habitat during high flows. Roads in flood plain may isolate these off-channel areas so they are no longer accessible to fish or completely fill them. A road system may not isolate or fill an off-channel area but by providing access to vehicles may result in loss of vegetation, bank stability, large wood input, cover, and a loss of overall habitat quality.

Questions addressed

Changes in physical channel dynamics (AQ – 9)
Affects to shading, litterfall and riparian plant communities (AQ – 11)
Affects of fishing, poaching and direct habitat loss for at-risk aquatic species (AQ – 12)

Rating

Flood Plain Function – Watershed Condition

1 = Main arterials and collectors are not located in valley bottoms or if located in valley bottom are not constricting the channels nor providing dispersed recreation access which is diminishing flood plain function or off-channel habitat quality. Flood plain connectivity, off-channel habitat and riparian reserves are rated as Functioning Appropriately.

3 = Some arterial and collector roads are located in the valley bottoms and are causing minor stream confinement. Dispersed recreation access is not resulting in adverse impacts to the flood plain, riparian function that affects aquatic habitat, or off channel habitat. Flood plain connectivity, off channel habitat and riparian reserves are rated as Functioning Appropriately. If riparian reserves are rated as Functioning at Risk the rating is not primarily due to the road system or dispersed recreation. While riparian reserves may be at risk, off channel habitat and flood plains are functioning appropriately.

9 = Main arterial and/or collectors are constricting streams so that floodplain connectivity and/or off channel habitat are rated At Risk and/or Riparian Conservation Areas are rated as At Risk due to dispersed recreation, or if there is concern over potential dispersed use, even if Riparian Conservation Areas are currently Functioning Appropriately. Dispersed use is not consistent with ACS or appears to be moving towards being inconsistent with ACS.

10 = Flood plain connectivity or off-channel habitat and/or Riparian Conservation Areas are considered to be Functioning At Unacceptable Risk due to road system and or dispersed recreation. Generally dispersed recreation would currently be inconsistent with ACS.

Flood Plain Function – Road Segment

1 = Road segment is not located in valley bottom or is located on toe slope in confined valley bottom outside the 100 year floodplain and not interfering with floodplain function.

6 = Road segment located on moderately confined valley or unconfined bottoms with localized areas of road encroachment on stream channel. Road location may be providing motorized off-road access onto flood plain or within riparian reserve such that flood plain or riparian habitat

conditions which affect aquatic habitat are showing signs of degrading in localized areas (see indicators above).

9 = Road segment located on unconfined valley bottom which frequently or continuously restricts channel migration, off-channel habitat and riparian habitat conditions affecting vegetation, altering movement of water, accelerating erosion processes, interfering with recruitment of large woody debris (LWD), and/or is providing access for motorized off-road dispersed use within the flood plain or riparian reserve to the point riparian habitat conditions affecting riparian habitat are being degraded.

Criterion 4: Flow Effects

Criterion 4 addresses if road segment:

Intercepts surface runoff and near surface ground water, along cut slopes and ditch lines, converting subsurface flows to surface flows.

Increases delivery efficiency of these flows by diverting them directly to streams.

Where these combined flows are continuous between roads and stream systems there is hydrologic connectivity. "Hydrologic connectively" is defined as any road segment that, during runoff, has a continuous surface flow between any part of the road prism and a natural stream channel. Water moves from hill slopes to valley bottom via surface and subsurface paths. Roads affect flow when they cut across hill slopes and/or require fill material through depressions that interrupt these natural paths. Road cut slopes or ditches intercept surface runoff and groundwater, accelerating their movement toward stream crossings. This action frequently increases soil erosion risks and routing efficiencies, which deliver road derived sediments and contaminants to streams and can alter peak flows and channel characteristics downstream. Precipitation runoff mechanisms including rain-on-snow, spring snowmelt and convectional storms should be considered when evaluating a road segment's hydrologic connectivity. Indicators of these effects include water interception on road surfaces and ditch lines, absences of ditch line relief culverts or cross drains, or interruption and detention of flows by road fill.

Questions addressed

Affects to surface and subsurface hydrology (AQ – 1)

Affects to water quality, quantity and hydrologic connectivity (AQ – 6)

Rating

1. Flow affects – Watershed Condition

1 = Roads are not greatly impacting watershed function. Road Density and Location, changes in peak/base flows are Functioning Appropriately.

3 = Road Density and Location are Functioning At Risk but Change in Peak/Base Flows is Functioning Appropriately

6 = Road Density and Location are Functioning At Risk or Unacceptable Risk and Change in Peak/Base Flows is Functioning At Risk

9 = Road Density and Location is Functioning At Risk or Unacceptable Risk and Change in Peak/Base flows is Functioning At Unacceptable Risk

2. Flow Effects – Road Segment

0 = Road segment is not intercepting concentrating runoff or groundwater in ditch lines. Runoff is cross-drained through a vegetative filter prior to reaching stream channels. Natural flow paths are maintained uninterrupted.

3 = Road segment is occasionally intercepting runoff, especially during peak events, but generally not groundwater. Delivery efficiencies are low due to combination of landform slope and weakly developed stream networks. Some additional ditch relief is necessary for routing surface runoff through vegetative filter. Downstream stream reaches may be susceptible to damage from increase peak flows.

9 = Road segment frequently intercepting both surface runoff and/or groundwater in sufficient volumes to influence flow downstream and delivering waters directly to streams. Landform slopes are steep and drainage densities high, providing increased delivery efficiency to stream channels. Downstream channels are unstable and susceptible to damage from increased peak flows. Road prisms may be interrupting and detaining water preventing it from recharging floodplain aquifers. Road has high hydrologic connectivity to the stream system.

Criterion 5: At-Risk Fish Populations

This criterion addresses the relative importance of a sub-watershed to the conservation and recovery of at-risk fish and to help weigh the potential for adverse impacts to at-risk fish or their habitat. Besides the potential impact to aquatic habitat, roads can increase the potential for poaching or introduction of exotic species.

Questions Addressed

Downstream beneficial uses of water and demands (AQ – 7)
Affects to migration and movement of aquatic organisms (AQ – 10)
Affects to fishing, poaching and direct habitat loss for at-risk aquatic species (AQ – 12)
Affects to areas of exceptionally high aquatic diversity or rare or unique species (AQ – 14)

Rating

1. At-Risk Fish Populations– Watershed Condition:

This criterion addresses whether fish listed for protection under the Endangered Species Act are present in the watershed and the relative importance to recovery within the sub-basin.

0 = No at-risk fish present in the sub-basin or watershed

1 = At-risk fish are present but there are no significant sub-watersheds.

3 = At-risk fish are present but there are no significant sub-watersheds because populations are depressed preventing identification of significant sub-watersheds or significant sub-watersheds have been identified but populations are very low and habitat is fragmented or severely degraded.

6 = At-risk populations are present with significant sub-watersheds for one or multiple species; habitat connectivity exists within the watershed. Habitat conditions are such that with relatively low investment in restoration the watershed could be a refugia from a habitat standpoint or management emphasis on restoration for other resources can be coordinated with aquatic/watershed restoration (such as "dry site or 303d.)

9 = Multiple significant sub-watersheds exist for multiple species or watershed represents a refugia within the sub-basin for one or more species

2. At-Risk Fish Populations – Road Segment (AQ - 7, 10, 12, 14)

1 = Road segment with the following set of conditions: road segments located in 6th field watershed with no listed fish species; stream crossings are not migration barriers (any life stage) for other fish species.

3 = Road segment is in a sub-watershed with at-risk fish or tributary to a watershed with at-risk fish, but neither the sub-watershed is within nor the sub-watershed downstream is a significant sub-watershed for an At-risk species. Stream crossings are not barriers to at-risk fish, but may be to other species.

5 = Road segment is in a sub-watershed with at-risk fish or tributary to a watershed with at-risk fish, but neither the sub-watershed is within nor the sub-watershed downstream is a significant sub-watershed for an At-risk species, but one or more crossings are present that present a barrier to at-risk fish at some life stage.

6 = Road segment is in a significant sub-watershed for an at-risk species or is a tributary to significant sub-watershed, no road crossings are barriers to any life stage of an at-risk species, poaching is not a major concern.

8 = Road segment is in a significant sub-watershed for an at-risk species or is tributary to a significant sub-watershed, no road crossings are barriers to any life stage of an at-risk species, but poaching due to access from the road segment is a concern though not necessarily documented.

10 = Road segment is in a significant sub-watershed for an at-risk species or is tributary to a significant sub-watershed. The road segment is or has potential, based upon the previous factors, to have serious adverse impacts to at-risk fish habitat; and/or there are road crossing barriers to some life stage of at-risk species and/or there is known poaching of at-risk fish occurring.

Criterion 6: Wetlands and Wet Meadows

This criterion address whether wetlands are present along road systems, if segments interfere with their condition and function, ground water movement or wetland vegetation.

A road segment's influence on the condition and function of adjacent wetlands is a result of either a direct impact such as:

A road location relative to the wetland
Indirect impacts related to the roads effect on the wetland supporting hydrology
Vegetative community and soil characteristics

The most notable effects include:

Converting productive wetlands to compacted road surfaces
Providing motorized off-road access into these areas
Constraining and diverting both surface and subsurface flows that support the water table
Intercepting runoff which can accelerate erosion and lower water tables
Increasing sediment loading and delivery of toxic pollutants
Conversions in plant species composition by introducing noxious weeds
Reducing base flows and increasing peak flow and flood frequencies and degrade water quality

Of these effects, those that affect the areas ability to receive, store and move water will likely have the greatest impact on the wetland's condition and function.

Questions Addressed

Affects of wetlands

Ratings

Listed below is a summary of hazard rating for road segments.
0 = Road segment is either not near or adjacent to wetlands/wet meadows, or road design characteristics are providing for the uninterrupted movement of surface and groundwater necessary to support the wetland's vegetation and soil characteristics.

3 = Road segment is adjacent to or crosses small localized wetlands or wet meadows. Road design characteristics, particularly crossings of surface and near surface water paths are limiting the available water necessary to inundate and saturate the landform and support the wetland's vegetation and soil characteristics. Initiation of wetland degradation including noxious weed establishment, increased sediment loading, and decreased area of saturation is occurring.

6 = Road segment is adjacent to or crosses landscape scale wetland's or wet meadows. The road's location and design have displaced or degraded the wetland's size and function. Runoff is being delivered directly to the wetland, increasing sediment and contaminant loadings. Crossings of surface and near surface water paths have severely limited the volume, timing and distribution of water necessary to saturate the landform and support the wetland's vegetation and soil characteristics. Road segment may be providing motorized off-road vehicle access into the area, further contributing to its degradation.

Table B-1. Aquatic impact/Risk

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
1	3700000	11.1	2	5	1	3	3	3	17	M	Need better surfacing and ditch relief and culvert sizing.
2	3700000	7.45	6	10	6	3	3	0	28	H	Direct delivery of material from upslope, cut and fills to Boulder Cr and to L Chewuch.
3	3900000	6.12	2	5	1	9	3	6	26	H	Ditch work and culvert sizing due to erosive native material; no direct entry to channel, extensive surfacing of subsurface water.
4	4010000	8.74	6	5	1	3	5	0	20	M	Steelhead present.
5	4100000	3.1	2	3	1	3	1	3	13	L	Erosion on cut and fill surfaces; is paved; low relief, few streams, low delivery. No surface connection to L Methow.
6	4100000	1.9	2	3	1	3	1	3	13	L	Erosion on cut and fill surfaces; is

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											paved; low relief, few streams, low delivery. No surface connection to L Methow.
7	4100000	4.8	2	3	1	3	1	3	13	L	Erosion on cut and fill surfaces; is paved; low relief, few streams, low delivery. No surface connection to L Methow.
8	4100000	7.1	2	3	1	3	1	3	13	L	Erosion on cut and fill surfaces; is paved; low relief, few streams, low delivery. No surface connection to L Methow.
9	4150000	2.6	2	5	6	3	1	0	17	M	Fill failures with potential to run to ephemeral channels, additional ditch relief or surface road drainage needed; localized constraining impacts on perennial channel and riparian habitat/floodplain; no connection with

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											L Methow.
10	4150000	6	2	5	6	3	1	0	17	M	Same as above.
11	4200000	6.5	2	1	1	0	1	3	8	L	Paved section; no surface connectivity to Beaver Cr.
12	4225000	6.3	2	10	9	3	5	3	32	H	Major erosion on cut and fill slopes draining directly to stream; highly erosive soils; provides access to riparian for dispersed rec use; livestock access via road compound erosion problems; culverts inadequate; major relocation or reconstruction or make a dead-end road instead of a loop above and below 4230 road junction. Reduce cattle access to riparian.
13	4230000	13.7	6	5	1	3	5	0	20	M	Check mileage, should be 7-8. High

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											erosion haz, high sed del, low veg recovery; eroded material is dissipated; cut and fill erosion, road surface erosion; improved drainage needed; B Trout, steelhead present; culverts are barriers.
14	4235000	11.5	6	10	1	3	5	3	28	H	High erosion haz, high sed del, low veg recovery; cut slope erosion drains into Lightening Cr, trib of Beaver Cr; historic B Trout, currently possible; located at toe of large wetland.
15	4300000	8.8	6	10	1	3	5	0	25	H	Libby Cr segment; localized failure above Bend Cyn Cr; steelhead spawning areas below failure zone; potential episodic mass failures from road;
16	4300000	3.9	2	3	1	3	3	3	15	L	Blackpine 1mi segment; high and

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											dry road on end of terminal morraine.
17	4300000	3.4	2	3	1	3	6	3	18	M	Buttermilk segment, paved; fluvial B Trout population blocked by culvert downstream (ON 4300 Rd); interferes with flow to wetland.
18	4330000	5.3	2	3	6	3	5	0	19	M	Lower S Fk Gold, question mileage: provides access to riparian; 2 culverts are barriers, to Rainy Cr and S Fk;
19	4340000	8.7	2	5	6	3	5	0	21	M	NFk Gold Cr; surface drainage, cut and fill slopes into stream; dispersed rec given access to floodplain; possible barriers.
20	4340000	4	2	10	10	3	5	3	33	H	Gold Cr paved segment; stream straightened, road undercut; 3/4 of road on private; major recon or relocation; historic spring chinook area;

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
21	4400000	7.4	0	1	1	0	6	0	8	L	Twisp N side, paved; road segment located on terrace above river; sig for 6sp chinook.
22	4410000	4	2	5	1	3	6	0	17	M	4 mi on Twisp side; road sur runoff, additional ditch relief needed; chinook/steelhead spawning, no barriers;
23	4410000	4.5	2	3	1	3	1	3	13	L	4.5 mi on Methow side; drains into Patterson Lake, is not draining at-risk habitat;
24	4415000	6.8	6	10	6	9	5	6	42	H	Little Bridge Cr; 4 mi on high erosion, high sed del, low veg recovery; high erosion from surface and cut/fill; many undersized culverts; dispersed rec conc to rip zone; trout and steelhead present, barriers present; need restriction of livestock to riparian.

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
25	4420000	3.41	2	3	6	3	6	0	20	M	Twisp R south/east end.
26	4430000	4.3	2	3	6	3	10	0	24	H	Twisp R south/mid segment; every road crossing on major streams rated as barriers.
27	4435000	4.05	6	3	6	3	6	0	24	H	Horse Camp down to Reynolds; zone of higher risk debris slides; has drivable dip at slide; mid and U Twisp are currently most productive Btrout and sp chinook; manage off-road access to wetlands.
28	4435000	0.15	0	3	6	0	8	0	17	M	Horse Camp Rd; flat segment provides access to river at possible spawning area; sig for chinook, poaching not known concern, redd trambling is.
29	4440000	6.5	9	5	1	0	10	0	25	H	Twisp R NW from Mystery Camp to roads end; major active landslide crosses the road,

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											being undercut by stream; undersized culverts; flat road segment; known poaching, will gate CG seasonally, manage dispersed rec use.
30	5005000	4.1	3	3	1	3	6	3	19	M	Wolf Cr Road; mid slope road
31	5010000	10.7	2	5	9	9	10	0	35	H	E side Chewuch; road on alluvial fans, some channel meandering at toe of fill; need sur drainage, more culverts; dispersed rec access excessive, degrades rip habitat; improve water crossings across alluvial fans.
32	5100000	10.6	2	3	9	3	8	0	25	H	W side Chewuch, paved; (Note spur roads are routing sed down onto tie segment.) Heavy dispersed rec use provided access to rip/floodplain; off road access and

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											disturbance to spawning fish - Respect the River.
33	5130000	11.14	6	10	9	3	6	3	37	H	Eightmile road, unpaved segment; elevated risk for debris slide; upper segment (1/2 - 1 mi) close to stream, fill slope direct delivery of sed to stream; cattle op plan needs review to restrict acces.;
34	5130000	5.2	2	10	9	3	6	3	33	H	Eightmile road, paved segment; frequent channel confinement affecting wood recruitment; provides livestock access;sed source problems - cut/fill slope 2 mi from Chewuch;same reasons for fish (6 rating) as above; rec access, LWD loss.
35	5140000	11.5	2	10	1	3	3	3	22	M	Falls Cr, paved; road cut/fill is prime sed source for Falls

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											Cr (1/4 mi, 1 mi above mouth) with direct entry to Chewuch; at-risk fish in lower 1/4 mi.
36	5160000	5.5	2	5	1	3	10	3	24	H	W side Chewuch from Camp 4, paved to Andrews Cr; dispersed access problems; road on terrace in area of mass waisting above chinook spawning area.
37	5200000	7.4	6	5	6	3	5	3	28	H	Cub Cr segment; high rd density; high sed load; at-risk fish lower 1 1/2 mi .
38	5200000	10.7	6	10	6	3	10	3	38	H	Cub Cr; undersized culverts contrib to road washout; road mile 8-9 near Vanderpool disp access to B Trout area; allows livestock entry; channel straightening has disconnected channel from FP/cold water seeps;

Road seg. #	FS rd. #	Seg. length	Geol. haz.	Rd-related fine sedim.	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating	Remarks
											sig B Trout spawning.
39	5215000	3.9	2	5	1	3	5	0	16	L	In Chewauh; crosses the drainage high up.
40	5215000	3.2	2	5	1	3	6	0	17	L	
41	5220000	9.8	6	10	6	6	3	3	34	H	Assume some barriers to res trout; assess replacing pipe at Ortell Cr.
42	5225000	4.7	2	5	1	3	3	0	14	L	Road to Flag Mtn above Blackpine Basin on a bench on Goat Wall; U Methow; dry,.
43	5225000	4.6	2	5	1	3	3	0	14	L	U Methow; Goat Wall creates a barrier for fish.
44	5400000	12	6	5	9	3	8	3	34	H	Main Methow Valley Road from Lost River to Harts Pass; disp rec vehicle use in FP, driving in channel.

Appendix C: Wildlife

Wildlife Rating Criteria

This section of the roads analysis characterizes the wildlife/road interactions that occur within each watershed within a sub-basin. The sub-basin analysis will identify Level 3-5 roads for management, prioritize watersheds for further analysis at the watershed scale based upon potential restoration needs for wildlife habitats, identify issues within watersheds, and establish the context for watershed scale roads analysis.

The analyses described below can be used to address wide-ranging carnivores, late-successional associated species, riparian-dependent species, ungulates, and unique habitats. Table C-1 provides an approach to rank watersheds based upon the wildlife issues within each watershed and the potential to provide benefits to the restoration of wildlife habitats. Table C-2 summarizes road-associated factors that affect wildlife habitats or populations (Wisdom et al. 1999). The analyses address the terrestrial wildlife (TW) roads analysis questions, TW (1), TW (2), TW (3), TW (4), and ecosystem functions (EF) question EF (2) identified in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" (U.S.D.A. Forest Service 1999). The analyses described in this document are adapted from the TW questions to better address the issues and conditions on the Okanogan and Wenatchee National Forests.

In the questions addressed section an alphanumeric code corresponds to the section in Appendix 1 of the "Roads Analysis Handbook." This code is linked to an ecological consideration, which has been formulated as a question. Each risk factor being evaluated addresses one or more of these questions. For more information about the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor, see the appendix.

Definitions

Impassable road: A road that is not reasonably or prudently passable by conventional four wheeled passenger vehicles, motorcycles or all terrain vehicles.

Restricted road: A road that is legally restricted, typically with gates or berms and information is available showing that use does not exceed 14 days.

Open road: A road open to motorized use during any portion of the season of concern for the particular species being addressed. If information is not available concerning the effectiveness of a gate or berm it may be best to assume it is open.

Table C–1. A relative ranking scheme to determine the priority of watersheds for watershed scale analysis within each sub-basin for each species group or habitat

Species Group/Habitat	High	Moderate	Low
Wide-Ranging Carnivores	9	5	1
Late-Successional Species	10	6	2
Riparian Dependent	10	6	2
Ungulates	9	5	1
Unique Habitats	10	6	2

Table C-2. Road-associated factors that negatively affect habitat or populations of wildlife species (based on Wisdom et al. 1999) and the wildlife species group for which effects of the road-associated factor has been documented

Road-associated factor	Effect of factor	Wildlife group affected
Hunting	Non-sustainable or non-desired legal harvest by hunting facilitated by road access.	Wide-ranging carnivores; Ungulates
Poaching	Increased illegal take of animals, as facilitated by roads.	Wide-ranging carnivores; Ungulates
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Chronic negative human interactions	Increased mortality of animals (e.g. euthanasia or shooting) due to increased contact with humans, as facilitated by road access.	Wide-ranging carnivores
Movement barrier	Interference with dispersal or other movements as posed by a road itself or by human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to the establishment of roads, road networks, and associated human activities.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats

Criterion 1: Wide-Ranging Carnivores

This group of species includes the grizzly bear (threatened), gray wolf (endangered), wolverine, and lynx (threatened). Several studies have documented the effects of road-associated factors on carnivores and they have included hunting, poaching, collisions, chronic negative human interactions, movement barriers, displacement/avoidance, habitat loss and fragmentation (Thiel 1985, McLellan and Shackleton 1988, Mech et al. 1988, Kasworm and Manley 1989, Mace et al. 1996, Singleton and Lehmkuhl 1998). Several questions remained unanswered about the relationship between lynx and roads. McKelvey et al. (1999) found no evidence that narrow, forest roads at relatively low road densities affected habitat use by lynx. However, their analyses did not address potential indirect effects of roads on habitat quality for lynx. There is some additional speculation that roads used during the winter for snowmobile routes may increase the interactions between lynx and other competitors such as bobcat and coyotes (Buskirk et al. 1999). Therefore, to err on the conservative side, road-associated factors and lynx are considered in this analysis.

Questions addressed

Direct effects on terrestrial species habitat (TW – 1)
Affect to habitat by facilitating human activities (TW – 2)
Affect to legal and illegal human activities such as trapping, hunting, poaching (TW – 3)

Rating

Analysis area: The watershed (5th Field) within the sub-basin (4th Field).

1. Follow the process described in the Interagency Grizzly Bear Committee Task Force Report (1998) to develop maps of core areas and road densities within each watershed in the sub-basin.
2. Identify issues and priorities for further watershed level roads analysis and for habitat restoration of Level 3-5 roads in each watershed within the sub-basin based on the following:
    a. Amount and location of core areas in the watershed.
    b. Road density within the watershed, defined as: high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.
    c. Proportion of the watershed affected by winter use of road in a Lynx Analysis Unit.
3. Relative Ranking. Based on the above information rank the watershed and the Level 3-5 road as follows:
    a. Low (1) – low potential to improve conditions for the target species.
    b. Moderate (5) – moderate potential to improve conditions for the target species.
    c. High (9) – high potential to improve conditions for the target species.

Criterion 2: Late-Successional Associated Species

Over 100 of the wildlife species identified on the Wenatchee National Forest were associated with some type of late-successional forest type (USDA FS 1997). A review of the available literature on these species showed that approximately one-third could be affected by roads or

road-related activities (USDA FS 1997). Road-associated factors that could affect these species include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (USDA FS 1997, Singleton and Lehmkuhl 1998, Wisdom et al. 1999).

Questions addressed

Direct effects on terrestrial species habitat (TW – 1)
Affects to habitat by facilitating human activities (TW – 2)
Affect to legal and illegal human activities such as trapping, hunting, poaching (TW – 3)

Ratings

Analysis Area: The watersheds within the sub-basin

1. Follow the process outlined in the Wenatchee National Forest Late-Successional Reserve Assessment (LSRA, page 107 of the forest wide). Refer to the LSRA to determine the current condition of security habitat within the LSR.
2. Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities for each watershed within the sub-basin based on the following:
   a. Juxtaposition of late-successional habitat to road or road segment.
   b. Road density (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.) and security habitat conditions within the LSR.
   c. Potential of the road to enhance security habitat within the LSR.
3. Relative Ranking. Based on the above information rank the watershed and the Level 3-5 roads as follows:
   a. Low (2) – low potential to improve the security habitat and habitat effectiveness in the LSR.
   b. Moderate (6) – moderate potential to improve the security habitat and habitat effectiveness in the LSR.
   c. High (10) – high potential to improve the security habitat and habitat effectiveness in the LSR.
   d. If none of the watershed is within an LSR score as 0.

Criterion 3: Riparian-Dependent Species

This group of wildlife species includes about 285 vertebrate species that are either directly dependent on riparian habitat or use them more than other habitats (Thomas et al. 1979). Road-associated factors that could affect these species include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (USDA FS 1997, Singleton and Lehmkuhl 1998, Maxwell and Hokit 1999, Wisdom et al. 1999).

This analysis addresses terrestrial wildlife roads analysis question TW (4) identified in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" (USDA FS 1999).

Questions Addressed

Affects of unique communities or special features (AW – 4)

Rating

1. The Analysis Area: The watersheds within the sub-basin.
2. Determine the area within riparian reserves and density of roads within riparian reserves.
3. Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities for each watershed within the sub-basin based on the following:
   a. Proportion and area of the watershed in riparian reserves.
   b. Road density within the riparian reserves (high = >2mi/mi^2, moderate =
   c. 1-2mi/mi^2, and low = <1 mi/mi^2).
   d. Proportion of Level 3-5 roads that occurs in the riparian reserve.

4. Relative Ranking. Based on the above information rank the watershed and Level 3-5 roads as follows:
   a. Low (2) – low potential to restore riparian habitat and habitat connectivity.
   b. Moderate (6) – moderate potential to restore riparian habitat and habitat connectivity.
   c. High (10) – high potential to restore riparian habitat and habitat connectivity.
   d. None (0) – road not located in a riparian reserve.

Criterion 4: Ungulates

This group of species includes mule deer, elk, mountain goats and bighorn sheep. Road-associated factors that could affect these species include hunting, poaching, collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (USDA FS 1997, Singleton and Lehmkuhl 1998, Canfield et al. 1999, Wisdom et al. 1999).

This analysis addresses, in part, terrestrial wildlife roads analysis questions TW (1), TW (2), and TW (3) identified in Roads Analysis: Informing Decisions about Managing the National Forest Transportation System (USDA FS 1999).

Questions Addressed

Direct effects on terrestrial species habitat (TW – 1)
Affects to habitat by facilitating human activities (TW – 2)
Affect to legal and illegal human activities, such as trapping, hunting, poaching (TW – 3)

Rating

1. Analysis Area: The watersheds within the sub-basin.
2. Determine the proportion and area of winter ranges, young rearing areas, and migration routes for these ungulate species within each watershed.
3. Identify the issues and priorities for further analysis and Level 3-5 road restoration opportunities based on the following:
   a. Proportion and area of the winter range, young rearing areas, and migration routes in each watershed.
   b. Density of roads (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2) within these areas, based on the assumption that road density is a good indicator of snowmobile/winter use.
   c. Potential of the Level 3-5 road to enhance winter range, based on actual winter range

and not EW (1), young rearing areas and migration routes through a management action.

4. Relative Ranking. Based on the above information rank the Level 3-5 roads and watershed as follows:
   a. Low (1) – low potential to enhance habitat effectiveness of winter ranges, young rearing areas and migration routes.
   b. Moderate (5) – moderate potential to enhance the habitat effectiveness of winter ranges, young rearing areas and migration routes.
   c. High (9) – high potential to enhance habitat effectiveness of winter ranges, young rearing areas and migration routes
   d. None (0) - not located on winter range, young rearing area or migration route for ungulates.

Criterion 5: Unique Habitats

Unique habitats include wetlands, talus slopes, caves, cliffs, snag patches, hardwood forests, etc. These habitats tend to be used disproportionate to their availability on a landscape, making them particularly important for wildlife and greatly enhancing biodiversity. Road-associated factors that could affect the wildlife species associated with these habitats include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (USDA FS 1997, Singleton and Lehmkuhl 1998, Wisdom et al. 1999).

This analysis addresses terrestrial wildlife roads analysis question TW (4) identified in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" (USDA FS 1999).

Questions Answered

Affects of unique communities or special features (AW – 4)

Rating

The Analysis Area: the watersheds within the sub-basin.

1. Identify the unique habitats within each watershed.
2. Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities based on the following:
   a. The density of unique habitats (acres/mile road within 100m of Level 3-5 road) within the watershed.
   b. The quantity of unique habitats (number of unique habitat types/road segment or road within 100m of Level 3-5 roads).
   c. Rating of unique habitats will be based on the following formula and then applied to relative ranking below:
      1) Low density + low quantity = low
      2) Low/moderate density + moderate quantity = moderate
      3) Moderate density + low/moderate quantity = moderate
      4) High/moderate density + high quantity = high
      5) High density + high/moderate quantity = high

      Determination of low/mod/high density and quantity will be a function of

statistical distribution and ecological situation specific to each sub-basin.

3. Relative Ranking. Based on the above information rank the watershed as follows:
   a. Low (2) – low density/quantity of unique habitats and low potential to restore unique habitats.
   b. Moderate (6) – moderate density/quantity of unique habitats and moderate potential to restore unique habitats.
   c. High (10) – high density/quantity of unique habitats and high potential to restore unique habitats.
   d. None (0) – Level 3-5 road does not affect unique habitats.

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Table C-3. Results of roads analysis, rating, and notes for wildlife habitat on Methow Sub-Basin

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
1	3700000	Lower Chewuch	11.1	9	0	10	5	6	30	H	see below
2	3700000	Lower Chewuch	7.45	5	0	10	5	6	26	H	Paved for about 6 miles. W-bisects core, wolf repts., few griz. rpts., good lynx hab., lots of snowmobile traffic, lower end hab. is not as good, upper 8 miles better; R-in creek.; U-deer winter range (WR); UH-boulders, some cliffs, some aspen.
3	3900000	Lower Chewuch	6.12	9	0	6	0	10	25	H	W- bisects core, sim. reasons to 3700, all WRC in there.; R-lots of crossings & wetlands, keep digging out ditches.; U-no WR, not much use; UH-lots of impt. wetlands, headwaters, snags, fire hab.
4	4010000	Lower Chewuch	8.74	5	0	2	5	6	18	M	W- not very diverse, would add core, some lynx; R-lower part right along Ck., majority not in R.; U-deer WR although not mapped, good area, snowmobile use.; UH-rattlesnakes, aspen.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
5	4100000	Lower Mainstem Oka.	3.1	1	0	2	1	10	14	M	For all sections of 4100, W-not good habitat, lots of priv. land, high RD, lo elev. mixed conifer forest.; R-not much in riparian.; U-some Fawning (F).; UH-talus, meadows, lots of aspen ("best in district"), wetlands, stream, hardwoods. (put in Middle Methow)
6	4100000	Lower Methow	1.9	1	0	2	1	10	14	M	see above.
7	4100000	Mainstem Chief Joe	4.8	1	0	2	1	10	14	M	see above. (put in Middle Methow)
8	4100000	Middle Methow	7.1	1	0	2	1	10	14	M	see above.
9	4150000	Lower Methow	2.6	1	0	10	5	2	18	M	W-could create island of core, some deer WR (prey), people could still access from both sides; R-almost right in water; U-in WR, but not heavy deer use, heavy hunt., some fawning; UH-aspen.
10	4150000	Middle Methow	6	1	0	10	5	2	18	M	see above.
11	4200000	Middle Methow	6.5	5	0	2	0	6	13	M	W-next to DNR land, moderate at best, lo/mid elev., not great hab., some lynx use, good wolf sighting in Tonasket; R-a few stream crossings, not much in reserve.;

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
											UH-aspen, wetland, rock outcrop.
12	4225000	Middle Methow	6.3	5	0	10	5	6	26	H	W-Moderate, pick up a little core, some lynx use, deer WR in bottom; R-in ck.; U-hi WR use, but snowmobilers are not quite in it; UH-wetlands, aspen.
13	4230000	Middle Methow	13.7	5	0	2	1	2	10	M	W-lynx use, will pick up a little core.; R- 2 crossings.; U-in WR, changing road maint. won't do much to habitat.
14	4235000	Middle Methow	11.5	5	0	2	0	2	9	L	Up to Starvation Mtn. W-goes into core, goes into more remote territory.; R-couple of crossings.
15	4300000	Lower Methow	8.8	5	0	10	1	6	22	H	W-could affect a lot of tribs., good hab, although highly "modified", fair human use, lynx hab., wolf reports.; R-comes down Mission Ck,; UH-lots of aspen, wetland, beaver ponds.
16	4300000	Twisp River	3.9	9	0	6	5	6	26	H	W-better core opportunities,; R-important Bull Trout streams, potential to lose snags; U-fawning; UH-aspen, wetland, beaver ponds.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
17	4300000	Twisp River	3.4	9	0	6	5	6	26	H	see above.
18	4330000	Lower Methow	5.3	5	1	6	5	2	19	M	W-would add core, maybe some lynx use, burned in 20's, all 70yr. old pine, poor to fair hab.; L-in eastern edge of LSR, thru burn, mod. traffic, hab. not great, modified.; U-lots of hunting, in WR.
19	4340000	Lower Methow	8.7	9	0	10	1	0	20	M	W-would add a lot of core, fair hab., but heavily modified; U-some WR.
20	4340000	Lower Methow	4	9	0	10	0	0	19	M	W-same as above; U-none.
21	4400000	Twisp River	7.4	5	1	6	5	10	27	H	W-along N. side of Twisp R., parallel road system on S. side, bisects core, need to close both systems to really be effective.; L-hab. values along road not great, esp. on lower end,; R-lots of crossings but most of road is off river.; U-impt. fawning.; UH-

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
											rattlesnake den, riparian, rocky, small aspen, wetland, hi snag dens.
22	4410000	Middle Methow	4	1	0	2	5	2	10	M	W-would not gain much core, priv. land,; R-low; U-some WR, F, migration; UH-patch of aspen.
23	4410000	Twisp River	4.5	1	0	2	5	2	10	M	see above.
24	4415000	Twisp River	6.8	5	0	6	5	2	18	M	W-good hab., mod. use, not much lynx use, some wolf rpts., bisects core.; L-only mod. because hab. values are not great, only upper end of road is in LSR; R-has a lot of tribs, doesn't get into rip. reserve as much; U-already seasonal fawn closure; UH-wetlands, aspen, couple of wet spots.
25	4420000	Twisp River	3.41	5	10	0	9	2	26	H	W-out to War Ck., parallel to Twisp R., no lynx; L-center of owl hab.; R-not in rip.; U-esp. impt. area for fawning.; UH-nice waterfall.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
26	4430000	Twisp River	4.3	5	6	10	9	2	32	H	Same as 4435, 4440, parallel to Twisp River and other road.; UH-snags
27	4435000	Twisp River	4.05	5	6	10	9	2	32	H	W/U-Same as 4440; L-owls, goshawks, frag. has occurred from past mgmt. practices more than road; UH-snags.
28	4435000	Twisp River	0.15	5	6	10	9	2	32	H	see above.
29	4440000	Twisp River	6.5	9	6	10	9	6	40	H	W-lynx, better hab., bisects core, finger.; L-bisects LSR, small road, fairly good shape.; R-in riparian for extended distance.; U-especially impt. fawning; UH-nice wetland @ North Ck., aspen, cottonwood.
30	5005000	Middle Methow	4.1	1	0	0	0	2	3	L	Wolf Ck., W-low elev., close to priv., hi use, wouldn't add much core; UH-nice wetlands, aspen.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
31	5010000	Lower Chewuch	10.7	1	0	10	9	2	22	H	W-along Chewuch R., another road on other side of R. so changing only 1 will not have much impact.; R-in riparian.; U-seg. from Boulder Ck. up a few miles = deer WR.; UH-dry, rocky, some cliffs.
32	5100000	Lower Chewuch	10.6	1	6	10	5	2	24	H	W-other side of Chewuch R., upper end would be (rate) much higher out toward 30-mile CG.; L-small section in Upper Methow LSR, good pine, songbirds, rd. is paved,; R-in riparian.; U-wide places, F.; UH-same as 5010.
33	5130000	Lower Chewuch	11.14	9	6	10	5	2	32	H	W-mod., habitat is good, runs into core, lynx photos, longer piece - rate high, out to wilderness (cows); L- In Upper Methow LSR. Bisects Nice LSR but similar effects as 5400. Some nice pine. road mgmt. wouldn't really change hab.; R- in riparian.; U-F. ***11.2 seg. upper
34	5130000	Lower Chewuch	5.2	5	6	6	5	2	24	H	Paved. W-lots of tribs, hi pot. to create core, would still be surrounded by roads, heavily modified (cows); U-close to Ck, fawning.; UH-wetlands, beaver ponds, ava. chutes near end,

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
											aspen. ***5.2 mi. seg., lower
35	5140000	Lower Chewuch	11.5	5	6	2	0	2	15	M	Paved, good wood cutting road. W-some nice lodgepole hab., doesn't get very high, heavily modified, could increase core.; L-In Upper Methow LSR. Lower habitat values, paved so would need major change, hab. is not outstanding, small part in Nice LSR, on corner, not much effect.; R-not much in hab.; UH-lots of snags, wetlands (off road).
36	5160000	Lower Chewuch	5.5	5	0	10	5	2	22	H	W-mod. habitat, another road across Chewuch R., seg. is paved.; R-in riparian.; U-lot of use, no WR, lots of hunters; UH-wetlands.
37	5200000	Lower Chewuch	7.4	1	0	2	1	2	6	L	W-lo, won't add much core because other road system nearby, although fairly good habitat.; R-stays out of creek.; U-mod.hunting, not much WR.; UH-some aspen, some wetlands.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
38	5200000	Middle Methow	10.7	5	6	6	1	2	20	M	W-mod., get more core area (island of core between Goat and Fawn Pk.), very hi RD, less modifications.; L-good habitat, esp. in upper Goat Ck.; UH-not much.
39	5215000	Lower Chewuch	3.9	1	0	2	5	2	10	M	W-some logging, fair to low for carnivores, maybe wolf in winter.;U-some WR, maybe F, lots of hunting.; UH-some aspen.
40	5215000	Middle Methow	3.2	1	0	2	5	2	10	M	W-same as above; R-one pond, a few crossings.; UH-some aspen.
41	5220000	Lower Chewuch	9.8	5	0	2	1	2	10	M	W-high RD, heavily modified, not much hab. although some ung., high human use, lots of black bears. R- a few crossings.; U-some F, no WR, hunted.
42	5225000	Middle Methow	4.7	9	6	2	9	2	28	H	W-could gain a lot of core, mod/hi habitat values, lynx, wolf sighting, connects to wilderness, class 1 grizzly sighting.; L-highly mod., not much for LSR values, in Upper Methow LSR, lots of activity, such as. grazing, logging.; R-lo, hi elev. with few crossings.; U- F, lots of hunting.

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
43	5225000	Upper Methow	4.6	9	6	2	9	2	28	H	see above.
44	5400000	Upper Methow	12	9	6	2	5	10	32	H	Narrow road, slower traffic, better hab. at bottom. High snowmobile use. W- lot of lynx use, high human use, Tussock Moth at lower end, leads to best doc. of wolverines on district, leads to wilderness, bisects core, sig. effect on watershed.; L-runs thru north side of Upper Methow LSR, connects LSR hab. to wilderness, high proportion of watershed is LSR.; R-runs high above ck., not in rip. hab., few crossings.; U-a few goats, artificially brought by salt lick, no WR, lower end is good deer fawning hab., summer range, impt. migration corridor but road doesn't really affect it.; UH-talus, ava. chutes, cliffs, wolverine denning hab., some hardwood

Seg. #	FS rd. #	Watershed	Length	Wide-range carniv.	Late-succ. species	Ripar. depend.	Ungul.	Unique hab.	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
			MEAN	4.73	1.91	5.55	4.14	4.00	20.32		***riparian issues - "One of the biggest problems on the district."
											***Parallel road systems in Chewuch River and Twisp River pose special problem.
											***core potential rates lower when there is an opportunity to improve core, but within an area with marginal habitat.

Table C-5. Road density of each Lynx Analysis Unit (LAU) on the Methow and Tonasket Sub-Basins

LAU	Road length (miles)	Total area (acres)	Total area (sq. miles)	Road density (mi/mi2)
Andrews Creek	0	21,851	34.1	0.0
Apex Mountain	0	30,575	47.8	0.0
Bald Mountain	0	35,776	55.9	0.0
Big Craggy Peak	67.7	26,021	40.7	1.7
Blue Buck Ridge	52.1	26,847	41.9	1.2
Bodie*	7.7	3,431	5.4	1.4
Bonaparte	137.6	44,137	69.0	2.0
Buckskin Ridge	0.3	37,123	58.0	0.0
Bunker Hill	0	34,977	54.7	0.0
Cascade Pass	0	43,467	67.9	0.0
Cecile Creek	101.4	43,307	67.7	1.5
Chocolate Glacier	0	37,227	58.2	0.0
Cooper Mountain*	39.8	28,382	44.3	0.9
Copper Peak*	0	35,383	55.3	0.0
Crescent Mountain	2.6	23,010	36.0	0.1
Dugout*	9.7	3,795	5.9	1.6
Eureka Lake	0	31,960	49.9	0.0
Farewell Peak	37.6	41,227	64.4	0.6
Ferry Peak	0	25,809	40.3	0.0
Fourth of July Basin*	0	37,720	58.9	0.0
Frisco Mountain	6.4	54,321	84.9	0.1
Frosty Lake	0	19,940	31.2	0.0
Glory Mountain	0	50,553	79.0	0.0
Granite Creek	16.7	46,330	72.4	0.2
Halfmoon Lake	2.2	27,886	43.6	0.1
Hancock Ridge	9.3	38,275	59.8	0.2
Horseshoe Creek	0	26,526	41.4	0.0
Hozomeen	0	24,522	38.3	0.0
Hungry Ridge*	23.2	27,769	43.4	0.5
Image Lake	0	29,704	46.4	0.0
Indianhead Basin*	0	31,711	49.5	0.0
Lease Creek	0	33,906	53.0	0.0
Many Traits Creek	0	21,594	33.7	0.0
Maple	61.6	32,884	51.4	1.2
Mazama	18.8	33,871	52.9	0.4
Methow Gold Creek	14.7	29,583	46.2	0.3
Middle Fork Boulder Creek	24.7	27,682	43.3	0.6
Milton Mountain	5.8	32,164	50.3	0.1
Monument Creek	3.1	28,115	43.9	0.1
Mount Blackenship	0	46,752	73.0	0.0
Nanny Goat Mountain	0	28,125	43.9	0.0

LAU	Road length (miles)	Total area (acres)	Total area (sq. miles)	Road density (mi/mi2)
North Fork Boulder Creek	30.5	15,594	24.4	1.3
North Fork Salmon Creek	58.6	24,795	38.7	1.5
North Fork Toats Coulee	0	42,256	66.0	0.0
Nohokomeen Glacier	0	27,512	43.0	0.0
Pugh Ridge	0	31,273	48.9	0.0
Purple Mountain	0	24,810	38.8	0.0
Rabbit Ridge	30.2	22,711	35.5	0.9
Sandy Butte	5.6	27,751	43.4	0.1
South Fork Beaver Creek	77.1	19,872	31.1	2.5
South Fork Toats Coulee	23.6	20,168	31.5	0.7
Slate Creek	16.8	54,861	85.7	0.2
Spectacle Buttes	0	28,965	45.3	0.0
Snowshoe Ridge	2.9	25,965	40.6	0.1
Spirit Mountain	19.2	23,275	36.4	0.5
Swan*	30	8,487	13.3	2.3
Thirtymile Peak	15.9	26,431	41.3	0.4
Three Fools Creek	0	44,100	68.9	0.0
Thunder Creek	0	29,053	45.4	0.0
Trinity	0	44,864	70.1	0.0
Tunk	91.1	27,042	42.3	2.2
Twisp	36.2	31,476	49.2	0.7
West Fork Salmon Creek	57.8	27,936	43.6	1.3
Whiteface Creek	56.8	27,651	43.2	1.3
Yarrow Creek	17	27,110	42.4	0.4

* Part of LAU is located on the Entiat/Chelan Sub-Basins or the Colville National Forest. These figures do not include areas on the Entiat/Chelan Sub-Basins or the Colville National Forest.

Appendix D: Recommended Actions

Road Analysis Recommended Management Actions

Recommended Management Actions are a group of alternatives that are possible options to meet the needs of the resources and the public. Any single action or combination of actions could be used. This analysis will give the broad category and the district will need to decide which actions are appropriate for each project.

A. Access needs to be maintained due to public needs; however, some major work or restrictions are needed to mitigate the resource impacts. Options include but are not limited to: relocation, major rehabilitation such as raising grade, surfacing, installing a large CMP or bridge, major storm proofing (investment needed, time & money).

B. Access needs to be maintained due to public needs; however some minor work or restrictions are needed to mitigate the resource impacts. Options include but are not limited to: seasonal restrictions or gating entrance, minor ditch work, adding small CMP, improved or more frequent maintenance, minor storm proofing (only enough work to address critical rating element).

C. Due to limited access needed and minimal resource impacts, these are candidates to leave as is, maintenance continues as is.

D. D. Access needs to be maintained due to limited public or resource needs and there are few or no resource impacts, so it would be possible to reduce the maintenance level.

E. Access may be available but due to budget constraints and minimal resource impacts, these are candidates to stop maintaining after putting in a self-maintaining status.

F. Access does not need to be maintained and some form of decommissioning to provide ecosystem restoration would mitigate resources impacts. Options include but are not limited to: blocking the entrance (includes gating for other than annual type seasonal use), rip & seed, removing culverts, partial or full obliteration.

Quandary: This is for segments when there are conflicting management recommendations.

Resolve all possible recommendations within the team. For all quandaries, write up why it is a quandary and present to line officer. Also provide short write up for each priority project, include: description, location, short and long term alternatives if needed.

Table D-1. Ratings and recommended management actions, alternatives

Aquatic rating	Wildlife rating	Human use rating	Recommended mgmt.
High	High	High	A
High or Moderate	High or Moderate	Low	E
Moderate	Moderate	Moderate	Quandary
Low or Moderate	Low or Moderate	High	B or D
Low	Low	Moderate	C
Low	Low	Low	D or E
High	Low or Moderate	High	A
Low or Moderate	High	High	A

Table D-2. Roads analysis recommended management actions, Methow Sub-Basin

Rd. seg. #	Watershed	FS rd. #	Road name	Seg. lngth	Aqua. rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Current maint. level	Current maint. cost	Prop. maint level	Cost to maint.	Final rec. mgmt.	Priority & remarks
1	Lower Chewuch	3700000	Middle Salmon Boulder	11.1	M	H	H	B	3	42180	3	42180		Better surfacing, cross drains
2	Lower Chewuch	3700000	Middle Salmon Boulder	7.45	H	H	H	A	4	17135	4	17135		stabilize eroding slope
3	Lower Chewuch	3900000	Meadows-Toats	6.12	H	H	M	A	3	23256	3	23256		ditch work, water control in wetlands
4	Lower Methow	4010000	Black Canyon	8.74	M	M	H	C	3	33212	3	33212		
5	Lower Mainstem Oka.	4100000	South Hunter Mtn.	3.1	L	M	H	C	4	7130	4	7130		
6	Lower Methow	4100000	South Hunter Mtn.	1.9	L	M	H	C	4	4370	4	4370		
7	Mainstem Chief Joe	4100000	South Hunter Mtn.	4.8	L	M	H	C	4	11040	4	11040		
8	Middle Methow	4100000	South Hunter Mtn.	7.1	L	M	H	C	4	16330	4	16330		
9	Lower Methow	4150000	Benson Creek	2.6	M	M	H	B	3	9880	3	9880		consider x-drains, repair fill failures
10	Middle Methow	4150000	Benson Creek	6	M	M	H	B	3	22800	3	22800		
11	Middle Methow	4200000	South Fork	6.5	L	M	H	C	3	24700	3	24700		

Rd. seg. #	Watershed	FS rd. #	Road name	Seg. lngth	Aqua. rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Current maint. level	Current maint. cost	Prop. maint level	Cost to maint.	Final rec. mgmt.	Priority & remarks
			Salmon											
12	Middle Methow	4225000	South Beaver	6.3	H	H	L	D	3	23940	2	6363		consider decommissioning last 1.5 mile for sediment and cattle concerns. Move cattle fence and guard to restrict cattle use.
13	Middle Methow	4230000	Beaver Summit	13.7	M	M	L	D/B	3	52060	2	13837		drainage improvements needed
14	Middle Methow	4235000	Starvation Mtn	11.5	H	L	L	D/B	3	43700	2	11615		drainage improvements, sediment control
15	Lower Methow	4300000	Buttermilk Libby	8.8	H	H	H	B	3	33440	3	33440		stabilize rd at Ben Canyon
16	Twisp River	4300000	Buttermilk Libby	3.9	L	H	H	C	3	14820	3	14820		
17	Twisp River	4300000	Buttermilk Libby	3.4	M	H	H	C	4	7820	4	7820		
18	Lower Methow	4330000	South Fk. Gold Creek	5.3	M	M	H	B	3	20140	3	20140		2 culverts are barriers
19	Lower Methow	4340000	North Fk. Gold Creek	8.7	M	M	H	B	3	33060	3	33060		stabilize cut/fill, mange disp rec, drainage
20	Lower Methow	4340000	North Fk. Gold Creek	4	H	M	H	A	4	9200	4	9200		consider reloc/reconst last 1/4 mi.

Rd. seg. #	Watershed	FS rd. #	Road name	Seg. lngth	Aqua. rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Current maint. level	Current maint. cost	Prop. maint level	Cost to maint.	Final rec. mgmt.	Priority & remarks
21	Twisp River	4400000	Twisp River	7.4	L	H	H	C	4	17020	4	17020		
22	Middle Methow	4410000	Coal Rader	4	M	M	H	B	3	15200	3	15200		need improved drainage & surfacing
23	Twisp River	4410000	Coal Rader	4.5	L	M	H	C	3	17100	3	17100		
24	Twisp River	4415000	Little Bridge Creek	6.8	H	M	H	A	3	25840	3	25840		improve erosion control, upgrade cmp, manage disp rec/cattle
25	Twisp River	4420000	Eagle Creek	3.41	M	H	H	C	3	12958	3	12958		manage disp rec
26	Twisp River	4430000	West Twisp River	4.3	H	H	L	A	3	16340	3	16340		consider spring closure, replace barriers
27	Twisp River	4435000	Reynolds	4.05	H	H	M	B	3	15390	3	15390		mange off road access
28	Twisp River	4435000	Reynolds	0.15	M	H	M	D	4	345	3	570		
29	Twisp River	4440000	Twisp River	6.5	H	H	M	A	3	24700	3	24700		consider relocation
30	Middle Methow	5005000	Virginian Ridge	4.1	M	L	H	C	3	15580	3	15580		
31	Lower Chewuch	5010000	Est Side Chewuch	10.7	H	H	H	A	3	40660	3	40660		consider obliterating summer home road to 20 mile jct, improve drainage, manage disp rec use.

Rd. seg. #	Watershed	FS rd. #	Road name	Seg. lngth	Aqua. rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Current maint. level	Current maint. cost	Prop. maint level	Cost to maint.	Final rec. mgmt.	Priority & remarks
32	Lower Chewuch	5100000	Chewuch	10.6	H	H	H	C	4	24380	4	24380		spur roads creating sediment, manage disp rec
33	Lower Chewuch	5130000	Eightmile	11.14	H	H	H	A	3	42332	3	42332		control live stream crossing by livestock, consider surfacing
34	Lower Chewuch	5130000	Eightmile	5.2	H	H	H	B	4	11960	4	11960		stabilize cut/fill slope, control live stream crossing by livestock
35	Lower Chewuch	5140000	Falls Creek	11.5	M	M	L	C	4	26450	4	26450		
36	Lower/Upper Chewuch	5160000	Chewuch	5.5	H	H	L	C	4	12650	4	12650		stabilize slide area above camp 4
37	Lower Chewuch	5200000	Cub Goat Creek	7.4	H	L	H	B	3	28120	3	28120		upgrade culverts for fish passage, improve drainage
38	Middle Methow	5200000	Cub Goat Creek	10.7	H	M	H	A	3	40660	3	40660		upgrade culverts for fish passage
39	Lower Chewuch	5215000	Boesel Canyon	3.9	L	M	L	D	3	14820	2	3939		
40	Middle Methow	5215000	Boesel Canyon	3.2	M	M	L	D	3	12160	2	3232		
41	Lower Chewuch	5220000	Ortell	9.8	H	M	L	D/B	3	37240	2	9898		consider improving drainage
42	Middle Methow	5225000	Blackpine Basin	4.7	L	H	H	C	3	17860	3	17860		

Rd. seg. #	Watershed	FS rd. #	Road name	Seg. lngth	Aqua. rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Current maint. level	Current maint. cost	Prop. maint level	Cost to maint.	Final rec. mgmt.	Priority & remarks
43	Upper Methow	5225000	Blackpine Basin	4.6	L	H	H	B/D	3	17480	2	4646		consider spring closure past look out
44	Upper Methow	5400000	Harts Pass	12	H	H	M	A	3	45600	3	45600		consider safety improvements, consider restricting off road access

Appendix E

Public Input to Roads Analysis

Methow Valley Ranger District

A public meeting was held on the district. There was little participation. In addition, approximately 200 letters were sent out to interested parties. No written responses were received in reply to either the meeting or letters.

Appendix F: Definitions

Definitions

Classified Road:
A road wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads and other roads authorized by the Forest Service.

Road:
A vehicle travel-way more than 50 inches wide unless designated and managed as a trail.
A road may be classified or unclassified or temporary.

Road Decommissioning:
Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Road Reconstruction:
Activity that results in improvements or realignment of an existing classified road.

Road Maintenance:
The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective.

Road Maintenance Levels:

1. Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities.

2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.

3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.

4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Dust abatement is a consideration.

5. Assigned to roads that provide a high degree of user comfort and convenience.

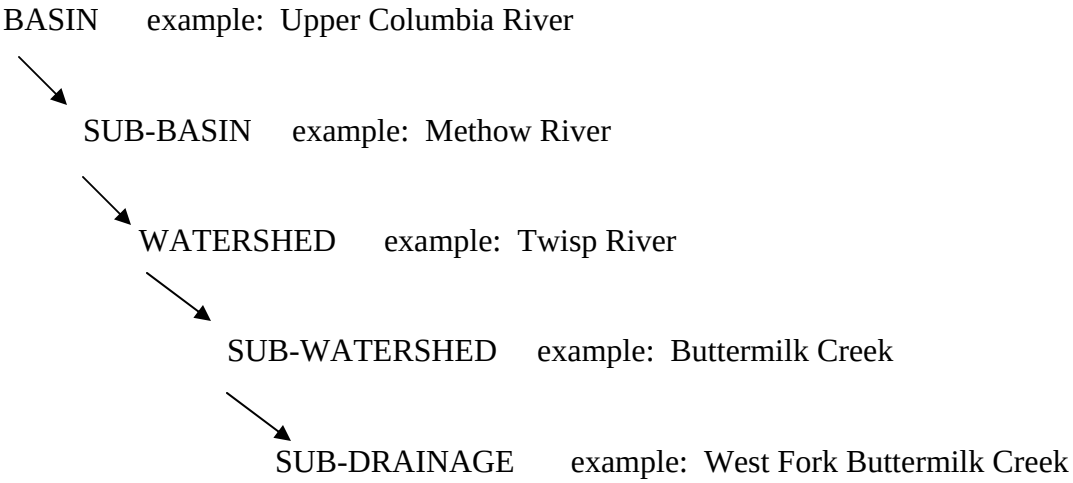
Roads Subject to Highway Safety Act:
National Forest System roads that are open to use by the public for standard passenger cars. This included roads with access restricted on a seasonal basis and roads closed during extreme weather conditions or for emergencies, but which are otherwise open for general public use.

Temporary Roads:
Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be part of the forest transportation system and not necessary for long-term resource management.

Unclassified Road:
A road on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travel-ways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.

Unroaded Areas (Roadless):
Areas that do not contain classified roads.

Watershed Hierarchy:
The terms Watershed, Basin, Sub-Basin, Sub-Watershed, and Sub-Drainage are used to describe a hierarchy of Watershed Areas that has been established by other agencies and the Forest Service. The hierarchy from largest to smallest is as follows:



Watershed Scale:
A watershed is the area drained by a distinct stream or river system and separated from other similar systems by ridge top boundaries. Watersheds catch and store precipitation, releasing the stored water to the stream channel.

Terms Used in Wildlife Rating Criteria

Impassable road:
Roads that are not reasonably or prudently passable by conventional four wheeled passenger vehicles, motorcycles or all terrain vehicles.

Open road:
Roads open to motorized use during any portion of the season of concern for the particular

species being addressed. If information is not available concerning the effectiveness of a gate or berm it may be best to assume it is open.

Restricted road:
Roads that are legally restricted, typically with gates or berms and
Information is available showing that use does not exceed 14 days.